THE IRON TRADE REVIEW

VOLUME XXXIII. CLEVELAND, O. MARCH 15, 1900. CHICAGO, ILL. NUMBER 11

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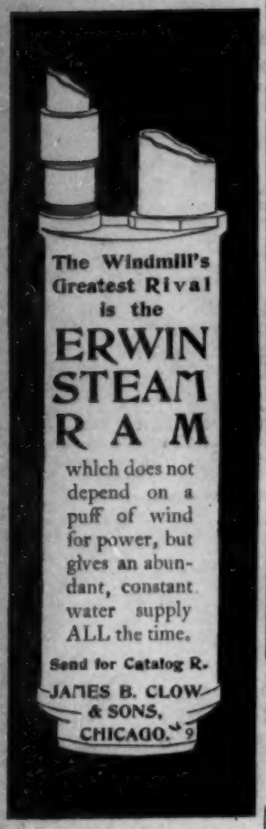
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THE IRON TRADE REVIEW

VOLUME XXXIII. CLEVELAND, O. MARCH 15, 1900. CHICAGO, ILL. NUMBER 11

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

Viewed from the standpoint of consumption, March has developed nothing as yet to support the belief that a turn toward a generally lower level of prices is near at hand. With all the hesitancy about contracts for foundry iron, which is a subordinate factor in the trade, and despite the fact of a so-called deadlock in steel, involving, however, only a fraction of the Bessemer steel production, there is a steady, strong demand for the delivery of material, upon furnaces, rolling mills, steel works, foundries and finishing plants in every line. This demand is altogether unprecedented at this time in the year. It continues and increases in spite of the fact that the crest of the wave of high prices was seen four months ago. Not only in the United States but throughout the iron using world, the conditions persist, of strong, broad demand and of supply only fairly equalling it. In Germany, as is well known, there is no promise that the stringency will be relieved short of another year. The March pig iron figures bear out what was said in February of the difficulty at many furnaces of getting up to an ordinary rate of production March repeats the experience, though in another quarter. A ten days' strike at New Castle means a considerable reduction in the month's quota, and though the strike is settled full output will not be reached at once and one of the furnaces will stop for repairs. The incident has only emphasized the close relation maintained between production and consumption of Bessemer iron in the Central West. This is shown strikingly this week by the depletion of metal carried at Pittsburg and the withdrawal of one concern from the billlet and sheet bar market, all the steel turned out being required for finishing departments. The demand for Bessemer iron for early shipment keeps up and a Western Pennsylvania furnace will go on to foundry iron, giving some little relief to the pressure. The foundry iron market is still dull, but the situation is strong at bottom. An increase in stocks by 37,000 tons in February is considered of no special moment, on the threshold of the active season. The developments in finished material are most encouraging, apart from the untoward possibilities of the Chicago strikes. Eastern work, including 17,000 tons for the Wanamaker building, will call for a large tonnage from structural mills. An inquiry for 12,000 tons of plates for vessel work on the Atlantic coast is reported, and Lake shipyards are figuring on a number of boats. As bearing on the outlook for the bar iron trade it is noted that the specifications received by the leading seller the past week were the largest since the beginning of the year. A conference of sheet mill consolidation promoters has been held in the week, and it is now said that prospects are good for the inclusion in the project of a large Pittsburg district interest and a Wheeling plant that have been reckoned as outside. The sheet mills close down this week for for appraisement.

PITTSBURG.

[OFFICE OF *The Iron Trade Review*. 1125-1126 PARK BUILDING, March 14.]

At the beginning of this week an important producer of steel in this district found its stock piles of iron entirely depleted, and no shipments large enough to permit of again gaining a reserve stock are likely for several months. This company, therefore, is no longer selling billets or sheet bars in the general market and all the steel made is going into its own finished product. The strike at the four valley furnaces, started on March 3, will no doubt be settled before the end of the week and the Bessemer output will again be increased 1,200 tons per day thereby. It was reported that the Red Jacket furnace had chilled, but this was not the case. The sales of Bessemer during the past week amounted to 16,000 tons by the association. The price of $24, valley, was rigidly maintained in every instance. The sale of a lot of 3,000 tons of Bessemer by an outside furnace is reported in which the association figure was slightly shaded. It is argued, however, by the furnacemen that this sale and a few sales from second hands recently made under varying circumstances, and in which the association price was shaded, have no bearing whatever on the market, the tonnage being insignificant. The continued sales of Bessemer at the association figure would indicate that this is the case. Arrangements were made by the association this week with a furnace East of Pittsburg which was on foundry iron, to work on Bessemer for 90 days. This reflects the halting demand for foundry iron. The presence of some Eastern iron has to a certain extent compelled the shading of quotations for Northern foundry irons. There is very little doing in gray forge and the Eastern product which was offered here several weeks ago is no longer to be had. Plates continue weak, a drop from 2.05c to 3c being noted. This figure, however, is only done on large orders. The increase granted the puddlers has caused a slight advance in muck bars and skelp is likewise firmer.

PIG IRON.—A sale of 500 tons of gray forge at $21, valley, is the largest transaction of the week reported in mill iron. The market seems to have recovered from the unsettled condition which existed several weeks ago and the Eastern and Southern mill irons offered here at prices below local quotations has apparently all been disposed of. The foundrymen are still holding off with large orders, believing that if there is a change in the market they will benefit thereby. They are also of the opinion that the market cannot work much higher and argue that a waiting policy is the wisest one. Sales of Bessemer continue despite the large sales for the month of February, and the present indications are that this month's sales will equal those of last month, as more than 30,000 tons has already been disposed of. We quote as follows:

Bessemer, valley furnace	$24.00
Bessemer, Pittsburg	24 90
No. 1 Foundry	23.25 to 23.75
No. 2 Foundry	22.50 to 23.00
No. 3 Foundry	21.75 to 22.25
Gray Forge, valley furnace	21 00 to 21.25
Gray Forge, Pittsburg	21.00 to 21.25

STEEL.—One of the largest steel producers in this district is no longer producing billets for the trade, using up all their product for its finished materials. The market remains quiet but firm, with only small sales reported. We continue to quote 4x4 billets at $35 and small billets at $36, at mill, Pittsburg, Wheeling or valley, though some lots through second hands are reported to have shaded this price. Sheet bars remain quiet but firm and we continue to quote $36 at mill.

FERRO-MANGANESE.—The quotation of $125 for domestic 80 per cent is unchanged.

RAILS AND TRACK MATERIAL.—There has been a brisk in-

quiry for track material during the past week and it is believed that by the first of next month large orders will be placed, for the laying of the thousands of tons of rails purchased last fall. Our quotations remain unchanged as follows: Rails, standard sections, over 200 tons, $35; 100 to 200 tons, $37; car lots, $38; less than car lots, $40; light rails, 25-pound and less than 50-pound, $37, all f. o. b. mill, Pittsburg; track material—spikes, 2.50c; track bolts, square nuts, 3.60c; hexagon nuts, 3.60c to 3.85c; splice bars, 2.50c to 2.60c; links and pins, 3c to 3.10c.

SPELTER.—The market has been quite steady during the past week and we again quote 4.60c to 4.65c for prime Western grades, Pittsburg.

SKELP.—Owing to the advance in wages granted the puddlers and the corresponding increase in the price of muck bars some of the mills have slightly advanced the price of skelp, holding grooved iron from 2.05c to 2.15c and grooved steel at 2c to 2.10c. Sheared iron is quoted at 2.25c and sheared steel at 2.20c.

MUCK BARS.—Although there is only a moderate demand for this product at the present time, the market is firmer owing to wage advances, and standard grades are quoted $32.50 to $33.

BARS.—Despite the fact that the demand has dropped off somewhat during the past week, local mills are adhering strictly to recent quotations. Eastern manufacturers are still cutting under Central Western mills in competitive territory. We continue the quotation of 2.25c for steel bars, in large lots, and 2.35c for small lots. Common iron bars are quoted at 2.15c, mill, and refined iron bars at 2.35c to 2.40c.

STRUCTURAL MATERIAL.—Local and Eastern mills have been requested to submit bids on the steel for a ten-story building to be erected for John Wanamaker, in Philadelphia. About 17,000 tons of steel will be required, and its delivery is to extend over a period of two years. This and other stipulations make the contract not altogether attractive and the competition will probably be confined to two bidders. It is believed the contract will be placed in the East. We quote as follows: Beams and channels, 3 to 15 inches 2.25c; 18 to 24 inches, 2.35c; tees, 2.30c; zees, 2.25c; angles, from 3 to 6 inches, 2.25c. Universal mill plates, 2.25c to 2.30c, according to delivery and size of order.

PIPES AND TUBES.—Jobbers all over the country are adopting the new schedule of prices recently arranged by the manufacturers of pipes and tubes and the indications are that the schedule will be generally adopted. During the week the jobbers of New York, Boston and St. Louis and Pittsburg adopted the schedule and those in the Middle West are favorably considering its adoption. Sales during the week, while not including large orders, were numerous and the demand continues very brisk. We quote the following discounts, Pittsburg: Black merchant pipe, ⅛ to ⅜ inch, 25, 10, 5 and 2½ per cent; ½ inch, 25, three 10s 5 and 2½; 1 to 4 inches, 30 and five 10s; 4½ to 12 inches inclusive, 30 and four 10s; galvanized takes 15 points less discount in the base. Screw and socket casings—2 inches, 20, 5 and 3½; 3 to 4½ inches inclusive, and 8¼ to 12½ inches inclusive, 30, two 10s and 4; inserted joints are 10 per cent higher. Iron boiler tubes—1 to 1½ inches, 20, 5 and 1; 1¾ to 2¼ inches, 20, 10 and 2½; 2¾ to 8 inches inclusive, 30, three 10s and 1½; 2½ and 9 to 13 inches inclusive, 30, 10 and 4½. Steel boiler tubes are about 5 per cent net less than iron.

PLATES.—Tank plates continue weak and large orders are accepted by some of the larger mills at 2c. This is a drop of 10c. during the past two weeks. It is claimed that only two mills are making this low quotation, and the largest producer and others are holding tank plates $2 to $3 a ton above the quotation named. On smaller lots assorted widths, the market ranges all the way from 2.10c to 2.25c. We quote shell steel at 2.25c to 2.30c; flange, 2.30c to 2.40c; fire box, 2.75c to 3.25c.

SHEETS.—The sheet mills of the Central West that will be included in the consolidation will close down Saturday for one week for the purpose of taking inventory. A meeting of the promoters was held in New York several days ago, and it is announced as a result that it is reasonably certain that a large local company and a Wheeling interest, thus far counted outside, will be included in the consolidation when the final apportionment of stock takes place. Prices remain firm, with little new business being placed. We continue to quote 3.05c for No. 27 gauge, and 3.10c for No. 28 gauge, one pass through cold rolls, with some mills asking 3.20c, not being anxious to accept any advance business. Galvanized sheets are firm with 75 the minimum discount and the usual 15-cent freight allowance. For small lots mills are quoting 70 and 10 and 70 and 10 and 5.

OLD MATERIAL.—There is only a limited demand for old material in this market at the present time. Local dealers' prices show quite a range. Our quotations follow: New basic melting stock, $26 to $29; new Bessemer melting stock, $23 to $25; basic open-hearth scrap, $25 to $28; steel rails, mixed lengths, $23 to $25; short lengths, $23.75 to $25.75; iron rails, $26 to $27; cast borings $13 to $14 gross tons; cast scrap, $18; No. 1 wrought scrap, $23 to $24, net tons; busheling scrap, $17 to $19, net tons.

COKE.—The market continues very firm, with no indication of lower quotations for several months. Foundry coke is quoted at $3.75 to 4.50 and furnace coke is quoted all the way from 3.50 to $4.25.

CHICAGO.

Office of The Iron Trade Review,
1522 MONADNOCK BLOCK, March 13.

With the exception of large sales of steel made by the local mills in the past 10 days there is no more activity in the market than at the time of our last report. Good specifications are being received all the time on old contracts, for both iron and steel, and some small buying is done every day, but consumers apper to think that by waiting until later they will be able to secure their supplies for the last half of the year at lower pricesthan are quoted now. Mills and furnaces, however, are very firm in their views, and maintain that there is little danger of prices decreasing. The strike situation is about the same as it was a week ago. Some more shops have had strikes called on them, but nearly all are now working, although some are shorthanded. Local business is affected by the strike to some extent, and if it continues will be effected more in the future.

PIG IRON.—A sale of 2,000 tons of Southern iron was made to the pipe people in the week, and they are in the market for more iron. Aside from this business not much was done, the total sales for the week not exceeding 5,000 tons. Nearly all of this was in small lots, the largest, probably, aside from the pipe order, being for 750 tons. Buyers are not anxious to place their business, but appear to think that they will get better figures by waiting until later, although the furnaces maintain there is little probability of this, and that statistics are against it. The business of the week was all at full schedule prices, and little is heard of lower figures being made. Quotations are as follows:

Lake Sup. Charcoal	$25 50 @ $26 50	Southern Coke No. 3	$20 85 @ $21 85
Local Coke Fdy. No. 1	24 00 @ 25 00	Southern No. 1 Soft	22 85 @ 23 35
Local Coke Fdy. No. 2	23 50 @ 24 00	Southern No. 2 Soft	21 85 @ 22 35
Local Coke Fdy. No. 3	23 00 @ 23 50	Southern Silveries	26 50 @ 27 00
Local Scotch Fdy. No. 1	24 50 @ 25 00	Jackson Co. Silveries	31 50 @ 32 50
Local Scotch Fdy. No. 2	23 50 @ 24 00	Ohio Strong Softeners	24 00 @ 25 00
Local Scotch Fdy. No. 3	23 00 @ 23 50	Alabama Car Wheel	25 00 @ 26 00
Southern Coke No. 1	22 85 @ 23 85	Malleable Bessemer	25 00 @ 26 00
Southern Coke No. 2	21 85 @ 22 85	Coke Bessemer	25 00 @ 26 00

BARS.—Some good orders were closed in the week, for steel, including one of 1,000 tons. New business for iron was light, and was limited to small lots. Specifications on old contracts are coming in very freely. The largest producer reports more material specified in the past week than in any previous week since the first of the year, and that consumers are taking iron about as fast as it can be got to them. The market is firm and unchanged at 2.30c for iron, and 2.35c for steel, half extras, Chicago delivery.

CAR ORDERS.—No large orders for cars were placed in the week, but several small contracts were given out. The demand for car material is good, and while little new business is being placed specifications on old contracts are freely given.

BILLETS AND RODS.—The local mills have sold about 40,000 tons of steel of various kinds, besides rails, in the past 10 days, included in which was an order for 15,000 tons of sheet bars and one for 15,000 tons of billets. A few smaller orders were also taken. The demand is good, and more business could have been taken were the mills in shape to handle it. Quotations are made at $35 for Bessemer billets; $39 for open-hearth billets; $37 for sheet bars; $65 for open-hearth rods, and $55 for Bessemer rods.

PLATES.—The market is weak, and prices do not seem to have reached bottom yet. Rumors of lower figures than we quote are frequent, and undoubtedly some steel has been sold at lower prices. Business has been fair, and one or two good sized lots have been disposed of in the week. An inquiry for a large tonnage of ship plates has been received from the east by the local mills. Quotations are lower, as follows: We quote tank steel from store 2.70c to 2.80c. Mill shipments, Chicago delivery: Tank steel 2.20c to 2.30c; shell, 2.30c to 2.40c; flange, 2.40c to 2.50c; marine, 2.55c to 2.65c; fire box, 2.85c and up, according to brand.

RAILS AND TRACK SUPPLIES.—The local mills took orders for about 43,000 tons of rails and fittings in the past ten days, from a Southwestern road. Other business was light, although there has been a good tonnage of orders for light sections in the past week or ten days. Quotations follow: Rails, standard sections, $35 to $38; light sections, $37 to $42; splice bars, 2.50c to 2.70c; spikes, 2.65c to 2.75c; track bolts, 3.85c to 3.95c.

STRUCTURAL MATERIAL.—The demand is small, and only a few small sales were made last week. The strikes in the building trades are largely to blame for this condition of affairs, as there are several good contracts which will undoubtedly go ahead as soon as the labor troubles are settled. Quotations follow: Beams, 15 inches and under, 2.40c; 18 inches and over, 2.50c; angles under three inches and over six inches, 2.50c; three inches to six inches, 2.40c; sheared plates 2.50c to 2.60c; universal plates, 2.50c to 2.65c; tees, 2.45c zees, 2.40c; small lots from store are quoted ¼c to ½c higher.

SHEETS.—There is a fair demand, and some good sized orders were closed during the week, but most buyers appear to be holding off until later in the season, in the hope of lower prices Quotations are made at 3.20c to 3.30c for No. 27 black, and 75 per cent off for galvanized, on mill shipments.

MERCHANT STEEL.—The situation is unchanged. Most of the business being placed comes from outside of the city, as the local buyers are not purchasing during the strike. Very little business was placed in the week except in small lots. Smooth finish tire steel is quoted 2.80c to 3c; smooth finish machinery steel, 2.95c to 3.05c; spring steel, 3.65c to 3.75c; tool steel, 7c to 7.50c; special, 13.50c and upwards.

MERCHANT PIPE.—Business has been fair, with one or two quite good contracts closed, but most of the tonnage is in small lots. Quotations are unchanged, discounts being as follows: Black merchant pipe, ⅜, ¼, and ⅜-inch, 25, 10 and 5 per cent; ½-inch, 25, three 10's and 4; ¾-inch, 30, four 10's and 4½; 1 to 4 inches, 30, four 10's 5 and 1½; 4½ to 12 inches, 30, three 10's and 8; galvanized, 15 points less discount in the base. Iron boiler tubes, 1 to 1½ inches, 20 and 3½; 1¼ to 2¼ inches, 20 and 10; 2¼ to 8 inches, 30, two 10's, 5 and 3; 2½ and 9 to 13 inches, 30, 10 and 1¼.

WIRE AND WIRE NAILS.—There is still no change in the situation, either as regards prices or business. The demand is large, and good sales are being made every day. Makers quote single car loads of wire nails at $3.53, f. o. b. Chicago, and $3.63 for less than carloads. On wire, current quotations are as follows: Plain annealed wire, $3.38; painted barb wire, $3.98; galvanized barb wire, $4.13.

OLD MATERIAL.—The largest consumer is still out of the market, but some buying has been done by mills outside of the consolation, in comparatively small lots. The demand for other grades than mill scrap is only small, and no large sales were made last week. Dealers' selling prices are about as follows:

Old iron rails, gross,	$24 00@$25 00	Country malleable	$14 00
Old steel rails, long, gr.	22 00	Iron axles, net	$27 00@28 00
Old steel rails, mixed	19 00@19 50	Cast borings, net	9 00@10 00
Relaying rails, gross	28 00@30 00	Wrought turnings, net	11 00@12 00
Old wheels, gross	24 00@24 50	Iron axle turnings, net	14 00@15 00
Railroad forge, net	24 00	Steel axle turnings	12 00@12 50
Dealer's forge, net	16 50@17 00	Mixed country steel, gr	13 50
No. 1 cut mill, net	14 00	Stove plates, net	10 00@10 50
Heavy cast, net	14 50@15 00	Heavy melting steel, gr	18 00@19 00
Railway malleable, net	15 00	Old iron splice b., net.	26 00

CLEVELAND.

OFFICE OF *The Iron Trade Review*,
27 VINCENT ST., March 14.

The managers of the docks at the ore unloading ports on Lake Erie have been in conference during the week with representatives of the labor organizations and indications now are that an amicable adjustment of all the principal points under consideration will be reached. The ore unloaders will be paid at the rate of 14 cents a ton as against 12½ cents at the close of the season last year. The unloading charge for vessels will be advanced from 16 to 20 cents. This apparent disparity in the advance is due to the fact that when the longshoremen were given an advance of 1½ cents per ton last summer the dock managers did not feel justified in advancing the charge for vessel interests. The transportation situation is devoid of developments. Little of the ore still on the market has been covered within the past seven days and there is a growing certainty that vesselmen who have not tied up are waiting for the "wild" market.

PIG IRON.—There is little doubt that active buying would commence tomorrow were the labor troubles at Chicago and elsewhere settled. There is a general fear that the trouble may spread and it is unmistakably exerting a depressing influence upon buyers. The movement of iron, particularly in the foundry grades, may reasonably be expected to become heavier as the month advances but it will not attain to anything like the proportions which would be reached under more auspicious conditions. Sales into the second quarter for Bessemer continue small but the market loses none of its strength. Although it has been given out that the association price of $24 for the third quarter is subject to change should conditions warrant, there is little expectation that an advance will be made. We quote the Cleveland market:

Bessemer	$24 90	Valley Scotch No. 1	$23 00@23 25
No. 1 Strong Foundry	22 75@23 25	Valley Scotch No. 2	22 50@22 75
No. 2 Strong Foundry	22 25@22 75	Gray Forge, valley	20 50@21 00
No. 3 Foundry	21 50@21 75	Lake Superior Charcoal.	25 00@26 00

FINISHED MATERIAL.—Structural material for local building purposes has constituted perhaps the best item on the list in the week just closed. Inquiry against specifications has been excellent and while new contracts closed are inconsiderable, it is known that several of some size are pending, with every likelihood of early consummation. The plate market continues weak but business aggregating several thousand tons was closed. A request submitted to a lake ship building corporation for estimates on the cost of two steamers of large size may ultimately develop a demand. The simplification of the sheet list seems to meet with general approval and an advance in sheets of No. 19 gauge and lighter is noted. There is an inquiry for about 6,000 tons of rails for electric roads. Among the bids submitted to the city of Cleveland for the superstucture of a new viaduct that of the King Bridge Co., at $94 per ton was the lowest. No change appears in bars. Specifications are being steadily made against contracts and there is promise of increasing activity on the part of consumers.

OLD MATERIAL.—The inactivity of the pig iron market together with other existing conditions holds the old material market well in check. Transactions may be said to have neither increased nor diminished. We quote as follows f. o. b. Cleveland: Gross tons—old iron rails, $24 to $25; old steel rails, $19.50 to $20.50; old car wheels, $22. Net tons—No. 1 railroad wrought scrap, $20 to $21; mill scrap, $14 to $15; No. 1 machinery scrap, $16; iron axles, $26; wrought turnings, $12 to $13; cast borings, $10 to $11; grate bars, $10; stove plate, $10 to $10.50.

CINCINNATI.

March 13.

Rogers, Brown & Co. say in their market review of the past week: "There has been no appreciable change in the conditions since our last report. The furnaces are all engaged on old contracts, and are not anxious for fresh orders requiring early delivery, except for such off grades and surplus lots as they chance to make in excess of obligations. The Southern furnaces have been producing of late lower numbers in higher silicons than usual, while the production of No. 2 foundry and No. 2 soft has been inadequate to meet demands of orders booked. The Northern furnaces are carrying little or no iron on their yards, though the situation is growing some easier. Bessemer and basic are as strong as ever, with no indication of weakness in any direction. The charcoal and coke furnaces making iron for car wheels and malleables are fairly guaranteed current prices for the year's production. The coke supply is still short of requirements, and many foundries are perplexed in securing a sufficient supply to maintain steady operation."

Matthew Addy & Co. report that "the market this week has shown more animation than previously and at the present writing there are several inquiries for round lots still unclosed. There has been a demand for Southern No. 2 foundry that it has been impossible to meet. The Southern furnaces are so largely sold ahead on that grade that it is practically impossible to secure any of it for quick shipment. There has been the usual trouble because of delayed shipments and the worst of this is the very apparent fact that the situation in this regard cannot be bettered for several months to come. In the meantime foundrymen are being put to an immense amount of trouble and annoyance. The Southern Ohio furnaces have proportionately been selling a great deal more iron than the Tennessee and Alabama furnaces."

We quote for cash f. o. b. Cincinnati: Southern coke, No. 1 foundry, $21.75; No. 2 foundry, $20.75; No. 3 foundry, $19.25; No. 4 and gray forge, $18.75; No. 1 soft, $21.75; No. 2 soft, $20.75; Lake Superior coke No. 1, $23.25 to $23.75; Lake Superior coke No. 2, $22.25 to $22.75; Hanging Rock charcoal No. 1, $25 to $26; Jackson county silvery No. 1, $30 to $31; Standard Georgia car wheel, $24.75 to $26.25; Lake Superior charcoal, $25.50 to $26.50.

PHILADELPHIA.

March 13.

With no increase in demand, and no sign for buyers that they are ready to adopt a new policy, prices of iron hold in a monotonous way. Stocks have increased—the gain for February being 37,000 tons—but with the spring advancing this is not enough of a factor apparently to influence prices. The possibilities of increased production appear to be less than has been counted on in many estimates. After going to the high mark on February 1, the estimated production of the active blast furnaces of the country fell off 4,500 tons a week or to 285,596 tons on March 1. Considerable is said about foreign iron markets and the effect of their strength on conditions in the United States; but these conditions, and indeed nearly all others that are given attention just now are looked upon as of future significance. Nothing has happened, nor has anything been urged as yet that has been effective in stimulating buying. Consumers seem to have no fear that they will be caught in a rush for metal and compelled to pay higher prices than today's. We repeat what has been said in the past several weeks, in which concessions have been made from December quotations, that there is an undercurrent of strength, probably sufficient to prevent any distinct decline. Some of the recent sales of gray forge iron, which were of considerable size, have been at $19 to $19.50 delivered, but in the other grades the sales have been in small lots, and in the case of standard irons, close to the quoted prices. We quote No. 1 foundry at $24 to $24.50; No. 2X foundry at $22.50 to $23.50; No. 2 plain $21.50 to $22.50. Muck bar is still quoted $30 to $30.50 at seller's mill, and billets are nominal at $35.50 to $36 asked. The finished maretail market shows well sustained activity, with no quotable changes in prices; but there is a disposition on the part of the mills to keep well filled and competition appears that results in attractive prices. We continue to quote best refined bar iron at 2.15c to 2.20c; tank plates, 2.10c to 2.15c; angles, 3 to 6 inches wide, 2.40c; beams and channels to 15 inches wide, 2.40c; No. 27 common black sheets 3.20c; No. 28, 3.30c to 3.40c. In old material steel stock is in good demand and brings $22.50 for heavy melting steel and $23 bid for scrap rails. Other forms are quoted: Choice railroad scrap, $23 to $25; No. 1 yard scrap, ordinary, $19 to $20; No. 2, light scrap, $14 to $15; machinery cast, $17 to $17.75; old iron rails, $24 to $26; wrought turnings, $15 to $15.50; cast borings, $13.50 to $14; old car wheels, $22 to $23; iron axles, $25 to $27; steel axles, $25 to $27.

JONES & LAUGHLINS, LTD., Pittsburg, this week broke ground for the erection of a new beam mill. It will have a capacity of 500 tons a day.

THE Chicago Association of Machinery Manufacturers has issued a special notice stating that since the national officers of the International Association of Machinists have declined to consider the proposition for arbitration submitted to them the association of manufacturers will consider no further communications from the union and will never recognize its demands. Notice is also given that the shops are open to former employes and the manufacturers invite all of there, save those who have been guilty of violence, to return to work.

THE IRON AND STEEL STOCKS.

The table below shows the changes in the iron and steel stocks in the week ending March 12, also the high and low points for the year, as reported by Denison, Prior & Co.:

Name.	WEEK.				YEAR.					
	Open	High	Low	Close	High.			Low.		
Am. Car & Fdy.....	15⅛	15⅜	14⅛	15¼	18	Feb.	7	12⅜	Jan.	15
Am. Car & Fdy pr.	60⅜	63	60⅞	63	66	Feb.	6	59	Jan.	29
Am. Steel & Wire..	55⅜	57¼	53¾	57	59¾	Feb.	15	45¼	Jan.	15
AmSteel & Wire pr	90½	92	90	92	95	Feb.	1	89	Jan.	15
Am. Steel Hoop.....	37½	37¾	32	36½	50½	Feb.	6	32	Mar.	6
Am. Steel Hoop pr	80	80	79⅝	80	86	Feb.	6	79	Mar.	1
Am. Tin Plate.....	33	33¼	30	33⅛	36⅜	Feb.	7	27⅜	Jan.	29
Am. Tin Plate pr..	80½	80⅝	80½	80⅝	84	Feb.	16	80¾	Jan.	12
Col. Fuel & Iron...	43¾	44½	42½	44⅜	48½	Feb.	6	40½	Jan.	8
Federal Steel.....	51	52¾	*48	50¾	57¾	Feb.	6	47¾	Jan.	11
Federal Steel pr....	73	73⅝	72	73⅛	77⅛	Feb.	6	70¾	Jan.	10
National Steel.....	43⅜	45⅞	41	45⅞	53⅜	Feb.	6	40	Jan.	26
National Steel pr..	95	96	94¾	96	97	Feb.	6	92	Jan.	9
Pressed Steel Car..	53⅜	53⅛	48	53⅜	58¾	Jan.	17	48	Mar.	10
PressedSteelCar pr	85	85	85	85	88½	Jan.	17	85	Mar.	2
Republic Steel.....	22	23⅜	19¾	22⅜	27½	Feb.	6	19⅜	Jan.	15
Republic Steel pr..	67	67¾	65⅝	67⅜	70¾	Feb.	6	64¾	Jan.	18
Tenn. Coal & Iron	94	95½	91½	95⅜	104	Feb.	2	79¾	Jan.	11

* Ex. Div.

The "Open Door" Policy at American Works.

It is stated that a German manufacturer who visited Pittsburg recently was surprised by the difference between the welcome he received then and that of about ten years ago. When he was there on the previous visit—with the Iron and Steel Institute in 1890—the manufacturers of Pittsburg gave an international entertainment and dined and wined their competitors from England, Germany, and France, showing them the wonders of natural gas and the resources of their plants. One day the program called for a visit to the Carnegie and other mills, and this particular German was invited to go and see how things were done in that country, he being a steel manufacturer himself. He refused the invitation on the ground that German manufacturers had nothing to learn from America, and he had come to the United States to get away from the clangour and smoke of the steel mills. It is different now. Having asked permission to inspect a certain mill and see the improved machinery and methods he had heard and read about, he was surprised at finding it impossible to obtain the required permit. Englishmen have generally succeeded in entering American steel mills, but manufacturers are stated to be becoming more and more chary in granting facilities for the inspection of their plants, and it is prophesied that the time will soon come when our experts will have to content themselves with an exterior view of Pittsburg's manufacturing establishments.—[London Iron and Coal Trades Review.

THE catalogue just issued by the Republic Iron & Steel Co., of Chicago, is given exceptional value as a work of ready reference by the wide range of products in the 1,000,000 tons of finished material turned out in a year at the 25 plants controlled by the Republic company. The lines of manufacture embrace merchant bar iron and steel, nuts, bolts, rivets, railroad spikes, cold drawn shafting, car axles, forgings, rails, splice bars, universal and tank plates, common and galvanized sheet iron and steel, Bessemer, foundry and mill pig iron. Special shapes for bicycle makers, car, implement, carriage, wagon and bridge builders are also manufactured. Embodied in the new list are a number of features which will be appreciated by the trade. These include the material iron classification, standard steel classification, National cut nail card for extras, standard lengths of cut nails and weights, keyseating lists, specifications for constructional iron, standard specifications as adopted by the Association of American Steel Manufacturers, tests of iron and steel, and notes on weight, area, etc., of iron and steel. The arrangement of the list of sizes is such as to facilitate ready reference. Another feature is the collection of lithographs of special shapes and sections made by the company. The volume contains over 200 pages, and is most completely ndexed. It is securely bound in flexible leather.

THE IRON TRADE REVIEW
AND
INDUSTRIAL WORLD.

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MARCH 15, 1900.

New Castle Furnace Strike Settled.

[Special Telegram.]

PITTSBURG, March 14.—The strike at the four furnaces at New Castle was settled last evening and this morning the blast at the Red Jacket and Rosena furnaces was turned on again after they had been banked since March 3. The Atlantic furnace will resume operation tomorrow. The Raney and Berger furnace of the National Steel Co. will be out temporarily for repairs.

Owing to the failure of several of the mills to make prompt returns of sales, the bi-monthly conference between the Amalgamated Association and the executive committee of the Association of Iron and Steel Sheet Manufacturers to adjust wages has been postponed. It will probably be held tomorrow, as the last return is expected to arrive today.

Personal.

F. E. Hall, formerly of Cleveland, will be superintendent of the blast furnace of the Charlotte Steel & Iron Works, which is about to start up at Charlotte, N. Y.

John Birkinbine, consulting engineer, of Philadelphia, is in Colorado on a professional trip.

Dr. David T. Day, of the United States Geological Survey, Washington, D. C., has sailed for Europe, and will install the petroleum exhibit at Paris.

W. E. Reed, secretary of the Warner & Swasey Co., Cleveland, sailed for Europe recently, and will set up the company's machinery at the Paris Exposition.

Paul Jacobi, of Strasburg, Germany, representing the extensive sheet metal-working firm of Wolf Netter & Jacobi, is visiting stamping and other metal-working concerns in the Central West. He has been in this country for six months and expects to spend some weeks in the Chicago district before returning home.

JULIAN KENNEDY, Pittsburg, is preparing plans for a new blast furnace of 300 tons capacity, to be built by the Iroquois Furnace Co., at Chicago.

THE Pittsburg, Connellsville & Wheeling Railroad Co., recently incorporated, and capitalized at $3,000,000 is in the market for rails, and the Carnegie Steel Co. is said to have been given the bulk of the order. The Pittsburg Locomotive Works is to furnish the engines.

THE American Tin Plate Co. is dismantling the plant formerly owned by the River Tin Plate Co., at Freedom, Pa. The machinery is being removed to the active plants of the company.

LARGE STEEL PLANT FOR CANADA.

A contract was closed by the Wellman-Seaver Engineering Co., of Cleveland, this week, to construct for the Nickel Steel Co., of Hamilton, Ont., a plant that will rival many on this side the line. The site selected is adjacent to the city of Hamilton and located directly upon Hamilton bay. The tract of land is a large one, and not only are the railroad facilities excellent but the depth of water is such as to enable ore carrying vessels to unload at the plant. It is the present intention to commence the construction of the buildings as soon as the frost is out of the ground and work will be pushed, although no date for the probable completion of the work is given.

The plant will consist, primarily, of four blast furnaces, the capacity of each being in the neighborhood of 600 or 700 tons daily. The furnaces will be located adjoining the docks and provided with a full equipment of appliances for handling ore. Ample provision will also be made for the storage of sufficient ore to supply the furnaces throughout the winter season. There will be two large open-hearth steel plants, each consisting of twelve 50-ton furnaces, making a total of 24 furnaces, with a daily capacity of 2,400 tons. In conjunction with the open-hearth plant will be a large mixer plant and pig casting machines. A blooming mill will be built of sufficient capacity to take care of the entire product of the open-hearth furnaces.

The finishing departments will consist of rail, billet and plate mills. There will be two separate plate mills, one arranged to roll plates of considerable width and thickness such as are required for the heaviest marine and boiler work and the other arranged for rolling from large to small sizes of plates in extra lengths for structural and bridge work. The machine shop, foundry and blacksmith shop will all be fully in keeping with the rest of the plant, both in size and equipment. It is the intention to use electrical power almost exclusively throughout the plant and the general installation of appliances will represent the best modern practice. The Nickel Steel Co. it is understood has secured large ore and coal properties which place it in an independent position as regards raw material and fuel. European capital is interested to a considerable extent in the project and it is expected that the trade of the plant will come from both the United States and Europe. The Canadian bonus of $5 a ton on steel will make shipment into the United States possible. The Wellman-Seaver Engineering Co. has designed the plant throughout and will supervise the construction up to the time the works are placed in actual operation. While no definite predictions are made as to the date of completion, it is hoped, should no unforeseen difficulties intervene, to be ready to put the furnaces in blast in March, 1901, and that the steel works will be ready for operation three to six months later.

The Wellman-Seaver Co. is executing at present several foreign commissions of some importance. One of these is for the remodeling of the plant of the Northeastern Steel Works, at Middlesbrough, Eng., and another is for an equipment of electrical machinery for the open-hearth steel plant and rail mill for the Imperial Steel Works of Japan. An electric traveling crane of 200 feet span is being installed at the steel works at Micheville, France, and electrical charging machines are under construction for the Spanish government.

WHEN the improvements now under way and those contemplated by the American Steel Hoop Co., for the Isabella Works at Etna, Pa., are completed, the capacity will be about doubled. Each of the three furnaces will have four new stoves, much larger than the old ones. The casting department of No. 1 furnace will be increased and the stockyards extended.

E. D. WOODS, representing the Stockton Mfg. Co., of Newark, N. J., and the A. P. Baumeister Co. and the Woods Specialty Co., of Granville, N. Y., was in Pittsburg this week, for the purpose of securing a manufacturing site for the centralization of the three plants in the Pittsburg district. The plants manufacture steel and iron specialties and employ about 400 men.

Carnegie Steel Co.'s Answer.

The answer of the Carnegie Steel Co., Ltd., defendant in the equity suit of H. C. Frick, to determine the value of his holdings in said company, was filed in common pleas court No. 1, at Pittsburg, Monday afternoon, March 12. The answers filed are for the Carnegie Steel Co., Ltd., and the thirty individual defendants below named: The Carnegie Steel Co., Ltd; Andrew Carnegie, C. M. Schwab, Thomas Morrison, James Gayley, W. W. Blackburn, J. Ogden Hoffman, James Scott, W. E. Corey, L. T. Brown, H. J. Lindsay, H. E. Tener, Jr., W. B. Dickson, John McLeod, A. R. Hunt, P. T. Berg, L. C. Phipps, W. H. Singer, D. M. Clemson, A. M. Moreland, John C. Fleming, George E. McCague, H. P. Bope, Joseph E. Schwab, D. G. Kerr, E. F. Wood, G. D. Packer, A. C. Case, C. W. Baker, A. O. Dinkey, Charles McCreery.

The other individual defendants are as follows: Henry Phipps, Jr.; George Lauder, now in Europe; H. M Curry, sick; A. R. Peacock, now in California; F. T. F. Lovejoy, who has already answered; George H. Wightman, now in Florida; Charles L. Taylor, now in California; A. R. Whitney, now in California; Millard Hunsiker, now in London, and George Megrew. The document complete makes nearly 20,000 words, meeting every averment of the plaintiff in fullest detail. We give in the main a synopsis of the answer below, as furnished to the press by Mr. Carnegie's attorneys, and quote in full some portions of the document:

Organization of the Association.

"It is denied that Andrew Carnegie and others named in the plaintiff's bill, during April, May and June, 1892, executed articles of association for the Carnegie Steel Co., Ltd., but they did subscribe to an amendment of the original certificate under which Carnegie Brothers & Co., Ltd., had been organized as a limited partnership association. Said amendment was not for the purpose of creating a new partnership or new partnership association but for modifying the terms of the original certificate.

At a meeting of the shareholders March 25th, 1892, at which the plaintiff H. C. Frick was present, a resolution was passed providing for such an amendment and a committee consisting of H. C. Frick, H. M. Curry and F. T. F. Lovejoy was appointed to carry out the details of a general plan which had been outlined. Mr. Frick was the principal actor on that committee. At a shareholder's meeting July 1st, 1892, the committee through Mr. Frick, submitted the amended certificate with the statement that it had been duly signed and executed by every member, and had been recorded. Upon Mr. Frick's motion said amendment was approved and adopted. If there was any defect in said articles as plaintiff now avers, he is primarily responsible for such in not properly and in good faith directing the details of the amendment entrusted to him by the other members of the association. The averments of plaintiff with reference to change of business are denied, as in the amended certificate the same language was employed as in the original; and in fact there has not been any change in the character of business.

It is true the name of the association was changed, and for the convenience of the business the principle offices were removed from Bessemer to Pittsburg. The business was enlarged subsequent to the change of name, but this in no wise changed the legal status of the association. The capital of the association was increased from five to 25 million dollars, and it is acknowledged that no provision was made for the payment into the treasury of the association of the original capital which had been subscribed in 1881. The absence of such provision for a second payment of capital previously paid in does not affect the legal status of the association; but may be taken as an evidence of the intent of the parties not to create a new association.

The increase in capital was not paid in coin or bank notes but it is true the association did receive said amount in cash in the manner in which commercial transactions of such extent are usually made—by the receipt of checks drawn on solvent and responsible banks which were regularly deposited to the credit of the association, and upon presentation at the bank were paid. In addition to the sum of $20,000,000 thus paid there has been paid into the association in cash and invested in its property and business more than double the amount.

In furtherance of the intention to increase its business and acquire additional plants, the association purchased the property of Carnegie, Phipps & Co., Ltd., a separate partnership association, for $10,000,000 and paid for same about June 30th, 1892, in the usual manner. The members of Carnegie, Phipps, & Co., Ltd., all being subscribers to the increased capital of the association, endorsed and delivered their dividend checks to the association, which were deposited and collected.

On the same day Carnegie Brothers & Co., Ltd., paid to its members a dividend of 200 per cent, or $10,000,000, representing the earnings previously invested in the company's property, and as the members receiving such dividends were all subscribers to its increased capital, endorsed and delivered the dividend checks to the association, which were deposited and collected in the usual manner. Such payment was good and sufficient as the checks were drawn on a solvent bank against an actual balance to their credit and the act was entirely in accordance with the true spirit and intent of the articles of association and the laws of the state.

The method of payment, if open to criticism (which is not admitted but denied) was devised, approved and carried out by the plaintiff; consequently the plaintiff is estopped from in any wise questioning the propriety and validity of his own acts.

With respect to the claim of plaintiff in the fourth paragraph of his bill the defendants are ignorant and call for proof. However, regardless of plaintiff's legal advice, recent or remote, or his belief as to the legal status of the association, his own actions in connection with it and its business have been such as to estop him from questioning the validity of its organization as a partnership association.

Mr. Frick's Interest.

The answer then sets forth the history of Mr. Frick's membership in the association. To begin with his interests were acquired in the same manner as other young partners. He was not required to pay for same, provision being made as in all cases of newly admitted members for payment out of the future profits. Mr. Frick's interest was acquired about Jan. 14, 1887, under the terms of what is known as the "Iron Clad Agreement" and amounted to $100,000 of the capital stock. In May, 1889, an option was given to Mr. Frick to acquire on Jan. 1st, 1894, an additional interest of 3 per cent. This option was abrogated in November, 1890, with Mr. Frick's consent, but as compensation he was credited in his account with the association with the sum of $138,146.68 representing the increment in the book value of the interest covered by his option from the time it was given until it was abrogated. Subsequently he acquired an additional 1 per cent and then 8 per cent for which he made no cash payment except as hereafter stated. In Feb. 1895, Mr. Frick was the owner of 11 per cent of the capital upon which he owed Andrew Carnegie one million eight hundred and nine thousand one hundred and ninety one and 83-100 dollars balance of purchase price. He was not, however, under his agreement with Mr. Carnegie personally liable, the interest acquired being the only security which Mr Carnegie held. It being at that time a period of business depression, Mr. Frick went to Mr. Carnegie and expressed a desire to reduce his holdings in the association requesting Mr. Carnegie to purchase at the book value 5 per cent of the 11 per cent held by him. Mr. Carnegie had no fears such as Mr. Frick expressed, and agreed to relieve Mr. Frick of the charge which Mr. Frick declared to be a burden upon him. Mr. Carnegie paid him the then book value which was greatly in excess of the price paid for it by Mr. Frick. After this transfer Mr. Frick held only 6 per cent of the whole, and the balance due on that percentage from Mr. Frick for the purchase price was finally adjusted and paid to Carnegie, the payment consisting of $129,000 in bonds of the H. C. Frick Coke Co. at par and $191.83 in cash.

This is all Mr. Frick has paid for his interests in the Carnegie Steel Co. With the credits from his stock earnings the amount paid was only $300,000 all told for an interest worth $5,000,000. He accepted without question the book value for 5 per cent of his holdings at a time when he was scared and feared the stock would depreciate, but now refuses to accept book valuation for the balance of his holdings. One-

third of the interest held at a time by Henry Phipps was also taken by Mr. Carnegie at book value.

Mr. Frick's Functions.

As to the value of Mr. Frick's services, which he claims largely added to the success of the association, the answer says:

"It is true that on the 14th day of January, 1889, the plaintiff was elected chairman of this association It is true that the plaintiff was re-elected as chairman from year to year, and continued to act as such until Jan. 11, 1895. From Jan. 11, 1895, to Dec. 5, 1899, the plaintiff was only chairman of the board of managers. On Jan. 11, 1895, the by-laws were amended and the office of president of this association was created, in whom were vested the general executive powers which had prior to that time been exercised by the chairman, and the duties of the chairman of the board of managers were limited to presiding at the meetings of the board, and to being ex officio a member of all committees of the same.

"Since the creation of the office of president in the year 1895 the business of the association has been conducted under the direction, supervision, and management of the persons who from time to time held the office of president. From Jan. 11, 1895, to April 1, 1897, this office was filled by John G. A. Leishman. Since the resignation of said Leishman said office has been filled by C. M. Schwab, who now holds it. The duties of the plaintiff, as chairman of the board, have been largely of the advisory character incidental to the office. He has attended the meetings of the board with regularity, and kept himself actively informed as to the business of the company, but his time has been largely employed in attention to his duties in connection with other enterprises in which he has been interested, and in various speculative schemes for placing the property of the association in the hands of promoters to be floated in marketable securities on the public.

"We do not question that in certain lines the plaintiff is a man of ability and we should have been glad to have him continue in the business of said association, had not he himself rendered such continuance impossible. The principle upon which this association is organized and conducted is that while various departments shall be committed to the management or supervision of the various members, all shall cooperate to the accomplishment of the general design, and to the success of the business, and that in the action of the board of managers, all matter submitted shall have the consideration of the nine members of said board, and the benefit of the independent judgment of each. The plaintiff, notwithstanding his ability, is a man of imperious temper, impatient of opposition and disposed to make a personal matter of any difference of opinion, even on questions of mere business policy. At times, moreover, he gives away to violent outbursts of passion, which he is either unable or unwilling to control. He demands absolute power and without it is not satisfied. After Jan. 11, 1895, when he ceased to be chairman of said association, and became merely chairman of its board of managers, the plaintiff was and continued to be restless and dissatisfied. He sought an enlargement of his powers, which could not properly be granted for the reason that such action, it was thought, would indicate a lack of confidence in the president of the association and would tend to destroy the influence and authority of his position as the chief executive. The plaintiff chafed under the limitation upon his powers, and the discordant situation which has acutely developed during the past year is largely due to the plaintiff's dissatisfaction with the transfer of the chief executive powers of the association to the president.

Mr. Carnegie's Participation in Management.

"It is true that the defendant, Andrew Carnegie, has for many years past resided in the city of New York, and that he has spent a portion of his time abroad. He has not been in recent years either an officer or manager of said association, nor has he undertaken the charge or management of its business in general or in detail; but, nevertheless, whether at home or abroad, he has always kept in close touch with said business and the management thereof, and in an advisory way has from time to time participated in said management. The practice of the association since the year 1895 has been to hold weekly meetings of its board of managers. At these weekly meetings full reports are made from all departments with respect to all matters of interest in the association's business. The substance of the discussions at these meetings is taken down stenographically, and a copy of these proceedings furnished to each absent manager, and to the defendant Carnegie. The proceedings are then entered in a book, and this record has been approved by the plaintiff in writing as chairman of the board, whereby the plaintiff has at all times had full and complete notice and actua knowledge of all matters transacted in the meetings of said board of managers. The defendants beg leave to refer at length to these proceedings as containing evidence of the close and careful attention given by the defendant Andrew Carnegie to all matters of importance in the management of the current business of the association, and also of the notice and knowledge of said matters had by the plaintiff.

"We deny that about Dec. 5, 1899, Carnegie, without cause, and actuated by malevolent motives, demanded the plaintiff's resignation of his position as chairman of the board of managers. We aver that the only motive which actuated Carnegie was a desire for what he believed to be, and what in fact was, for the best interests of the association. We deny that plaintiff's resignation was demanded by Carnegie. The plaintiff was informed by Carnegie that he had better resign for his own sake and to avoid the necessity of a refusal to re-elect him at the approaching annual meeting. This, however, was done in the kindliest spirit and after all the acting members of the board of managers had signed a paper requesting the plaintiff to resign his office. We deny that plaintiff's resignation as chairman was actuated by any other motive than a desire to escape the humiliation of being removed without his consent by his partners. We admit that the plaintiff had participated in the association's business up to the time of his resignation, and that some of its affairs were conducted under his supervision."

The answer next sets forth that Andrew Carnegie has been a member of the association since its original organization and at the present time his interest is 58⅓ per cent. It is acknowledged that some of the members whose names are affixed to the amended certificate of 1892 have disposed of their interest in the association and from time to time new members have been admitted who have acquired such upon the basis of the book value as prescribed in the iron clad agreement, a copy of which was annexed to the contract under which Mr. Frick became a member of the association, and which is printed as part of the answer.

It is denied that Mr. Carnegie controlled or sought to control the action of his associate partners, although owning at all times over 50 per cent of the capital, but by reason of Mr. Carnegie's age and business experience, many or all of the partners were willing to hear with deference his views on matters pertaining to the business, at all times, but Carnegie expected them all to exercise and they did exercise their own judgments. Mr. Carnegie, it is asserted, has held an interest in excess of 50 per cent rather from the necessity of taking the shares of timid, deceased or retiring members than from any desire or intention on his part to hold a controlling interest, and during all the years of the association's existence Carnegie was the sole man who never lost faith or faltered in his belief that the city of Pittsburg was the best place in the world to make steel cheapest.

Mr. Carnegie's Estimate of $40,000,000 Profit.

Touching upon the profits of the company and the attempt to organize a stock company the answer states that Mr. Carnegie while at luncheon with the plaintiff and others connected with the company, by way of jest undertook to make estimates of the profits of the company for the year 1900, and that the defendant Andrew Carnegie, under the conditions then existing did make an estimate substantially as averred in the ninth paragraph of plaintiff's bill, such estimate, however, being a mere guess at results to be ascertained 14 months in the future which were then and still are involved in great uncertainty.

"It is also true that for the year 1899 the profits of said company were substantially as averred by the plaintiff in said paragraph. The profits so stated, however, refer only to the difference between the amount of sales and the actual

expenses of manufacture, and do not, by any means, indicate the amount available for distribution as dividends among the members of said association. The actual capital of said association by reason of its accumulated and invested earnings, is largely in excess of its nominal capital, and the present condition of prosperity in said business is entirely exceptional. It is greater than it has ever been in the past, and its continuance is altogether uncertain. Moreover, in order to maintain the standard of economy and efficiency which is requisite to the continued success of the company, it has been necessary in the past and will be necessary in the future to absorb a large part of the annual profits of the company in extension and enlargement of its property and facilities, in the purchase of modern machinery and appliances, and the adoption of new methods and processes. Of the profits of the year 1899 above referred to, it was not thought proper to distribute more than one-fourth thereof as dividends among the members of the association, and the remaining three-fourths necessarily went into the business of the company.

"It is not true that on Dec. 31, 1899, the said association had assets or property, either real or personal or tangible, in any form, which the said association in its legal capacity could transfer, which were worth $250,000,000; nor did the defendant Andrew Carnegie ever assert that said assets were in excess of that sum. The said Andrew Carnegie has repeatedly expressed the opinion with reference to the earning capacity of said company, that the personnel of its organization was worth more than all the property of the company. It is true that the said Andrew Carnegie has expressed and still holds sanguine views as to the future of said company, but any such views are based upon the maintenance of the organization of the said company in its present condition of efficiency and harmony.

Capitalizing the Company's Future Prosperity.

"The facts which the plaintiff has distorted in order to give color to the averments contained in the ninth paragraph of the bill, are these: For some time past the plaintiff has been interesting himself in schemes to transfer the property of this association at first to a proposed combination of steel companies, and later to a corporation whose securities might be floated on the market and disposed of to the public upon the basis of a capitalization of the earning power of the plant owned by the association in combination with the skill, experience and ability of its members. We have no purpose or intent to depreciate the earning power of our property when managed by its present organized membership. But it has always been the policy of this association from its outset to regard itself as an association of individuals, who have united together their fortune, their talents, and their industry to manufacture iron and steel in all branches in the best form, by the best processes, and at the most moderate cost, and by such attention to the true purpose of its organization to produce for those interested in the association the largest profits which can be made. As a means of securing the best results and the most intelligent attention to the details of the business, by which alone can manufacturing operations be conducted at a profit, it was the policy of those whose intelligence and faith in results founded the business to associate with themselves from time to time a number of young employes, who, by becoming directly members of the association, would be stimulated to the very best work. The result has justified the belief that this method, was the true method of carrying on large operations, and the profits which have resulted do not represent simply earnings or interest on the capital invested, but have been the product from year to year of the brains, intelligence, and industry of the several members who in their separate departments have so conducted the business of the association as to produce this profit. Any capitalization of the earning power of the enterprise as a going concern would in nowise represent only the value of the plant and other property which are the assets of the association, and to which alone upon his withdrawal, retirement, or exclusion from the association the plaintiff is entitled to an account. Such capitalization would be based upon the continued operation of the plant by the members, upon whose future earning power the plaintiff has no lien or claim.

"Having so answered, we do respectfully suggest that any such estimate of values of our assets as is contained in the ninth paragraph of plaintiff's bill is wholly immaterial, as we are advised, in the present case. The rights of the plaintiff touching the price which is to be paid to him for his interest are based altogether upon the "ironclad agreement" to which he is a party. The value of his interest is by the terms of said agreement to be ascertained by reference to the books of the company. Those books were under the supervision of the plaintiff until the day of his resignation from the chairmanship of our company, and the entries have been made from time to time in accordance with his express judgment.

Book Value at Close of 1899 Was $75,000,000.

"These books show that the net value on the 31st day of December, 1899, of the assets of the association was $75 610,-104.06. To a large extent this book value represents the actual cost of the properties represented in the balance sheets of the association. From time to time during the plaintiff's membership in the association he, and other members, were appointed a committee to revalue certain assets. In every instance of such revaluation the plaintiff himself has been a member of such committee, and the values now entered and the properties included as having value may be taken as the plaintiff's own statement of their value to his fellow-members, on which, during plaintiff's membership more than 15 settlements have been made with retiring members or the estates of deceased members.

No Animus on Mr. Carnegie's Part.

"The averments contained in the eleventh paragraph of the bill are not true, and in particular it is not true that the defendant Andrew Carnegie has conceived a personal animosity toward the plaintiff. If any animosity exists, such animosity exists solely on the part of the plaintiff. The defendant Andrew Carnegie has at all times entertained and exhibited toward the plaintiff the most kindly sentiments, and although there have been times when it became necessary to oppose the views and projects of the plaintiff, the said Carnegie has endeavored at all times to deal with him in the most generous spirit and with the most sincere regard for his interests. The inuendo that an animosity had arisen from the failure of the plaintiff, in connection with others, to avail of an option given by said Carnegie, as referred to in the eleventh paragraph of the bill, is not true, because the fact is, that the defendant Carnegie was never anxious that the said plaintiff and his associates should avail of said option. The facts with reference to the same are these:

History of the Moore Project.

"As has been heretofore stated, the plaintiff has for some years past been desirous of transferring the property of this association to a corporation upon a large capitalization, and to float its securities with the general public. The said Carnegie had never been inclined personally to favor said scheme.

"Early in the year 1899 the plaintiff, with W. H. Moore and Henry Phipps, Jr., conceived the scheme of effecting an organization to purchase the property and business of this association and of the H. C. Frick Coke Co., and thereafter said Frick and Phipps requested an option for the purchase thereof for the price of $320,000,000, being on the basis of $250,000,000 for the property of this association and of $70,000,000 for the property of the said coke company, it being understood that the older members of this association should permanently retire from said business and that the younger members thereof engaged in the active practical management of the business should bind themselves by contract to remain with the new organization for specified periods. After negotiations it was finally agreed that an option for said purchase should be given for a limited period upon the payment of the sum of $2,000,000 as an earnest of good faith, the same to be credited as a part of the price should said purchase be made, and otherwise to be forfeited, Frick and Phipps thereafter persuaded the other members of the association, (with the exception of Mr. Carnegie), to the extent of their respective interests in the company, to release Frick and Phipps from the payment of any cash consideration for said option. This arrangement resulted in the execution and delivery of two options, to wit, one by Carnegie

(Continued on page 19.)

BESSEMER STEEL PRODUCTION IN 1899.

The current issue of the *Bulletin* contains the statistics just collected by General Manager Swank of the American Iron and Steel Association showing the production of Bessemer steel ingots and Bessemer steel rails in the United States in 1899. We reproduce the figures and the comment below. The comparatively small quantity of standard rails and street rails made from purchased blooms or re-rolled from old steel rails is not included. There were no Clapp-Griffiths works in operation in 1899 and only one Robert-Bessemer plant was active. Four Tropenas plants were at work in that year, and all were employed in the production of steel castings. The ingot statistics include the production of a few thousand tons of Bessemer steel castings.

Ingots.—The total production of Bessemer steel ingots in 1899 was 7,586,354 gross tons, against 6,609,017 tons in 1898, showing an increase in 1899 of 977,337 tons, or over 14 per cent. The production in 1899 was very much the largest in our history. It was more than twice the production of 1894, and was almost twice the production of 1896. Of the total production in 1899, 3,939 tons were steel castings, against a similar production in 1898 of 3,539 tons. The following table gives our production of Bessemer steel ingots, including direct castings, in the last six years:

Years. Gross tons.	Bessemer ingots.	Years. Gross tons.	Bessemer ingots.
1894	3,571,313	1897	5,475,315
1895	4,909,128	1898	6,609,017
1896	3,919,906	1899	7,586,354

The table below gives the production of Bessemer steel ingots in the last four years:

States—Ingots.	1896. Gross tons.	1897. Gross tons.	1898. Gross tons.	1899. Gross tons.
Pennsylvania	2,292,814	3,060,049	3,402,254	3,968,779
Ohio	568,535	1,041,541	1,489,115	1,679,237
Illinois	780,105	943,774	1,105,040	1,211,246
Other States	278,452	429,951	612,608	727,092
Total	3,919,906	5,475,315	6,609,017	7,586,354

Rails.—The production of all kinds of Bessemer steel rails by the producers of Bessemer steel ingots in 1899 was 2,240,767 gross tons, against a similar production in 1898 of 1,955,427 tons and 1,614,399 tons in 1897. The maximum production of Bessemer steel rails by the producers of Bessemer steel ingots was reached in 1899. The year of next largest production was 1887, 12 years ago, when 2,044,819 tons were made. The following table shows the production by States of Bessemer steel rails by the producers of Bessemer steel ingots in the last four years. The figures given do not include the rails made each year from purchased blooms or re-rolled rails, statistics for both of which products for 1899 are not yet available:

States—Rails.	1896. Gross tons.	1897. Gross tons.	1898. Gross tons.	1899. Gross tons.
Pennsylvania	663,096	1,024,386	1,052,771	1,224,807
Other States	439,796	590,013	902,656	1,015,960
Total	1,102,892	1,614,399	1,955,427	2,240,767

The production of Bessemer steel rails weighing 45 pounds and less than 85 pounds to the yard is separated from those weighing less than 45 pounds and over 85 pounds as follows:

States—Rails.	Under 45 pounds. Gross tons.	45 pounds and less than 85. Gross tons.	85 pounds and over. Gross tons.	Total. Gross tons.
Pennsylvania	62,639	835,801	326,367	1,224,807
Other States	67,496	695,307	253,157	1,015,960
Total	130,135	1,531,108	579,524	2,240,767

The total production of rails in 1899 will include rails made from open-hearth steel and iron rails. When all the figures are obtained it will probably be found that our total production of all kinds of rails in 1899 was about 2,300,000 tons.

OUTPUT OF BLAST FURNACES OF UNITED STATES.*

March 1, 1900.

Location of Furnaces.	Coke and Anthracite. Total No. of Stacks.	In Blast. Number.	In Blast. Weekly capacity.	Out of Blast. Number.	Out of Blast. Weekly capacity.	Charcoal. Total No. of Stacks.	In Blast. Number.	In Blast. Weekly capacity.	Out of Blast. Number.	Out of Blast. Weekly capacity.
New York	13	6	7054	7	3650	2	1	100	1	95
New Jersey	7	6	3493	1	300	.....	.....	.....	.....	.....
Spiegel	2	2	560	0	0	.....	.....	.....	.....	.....
Pennsylvania:						13	0	0	13	670
Lehigh Valley	27	25	12743	2	1060	.....	.....	.....	.....	.....
Spiegel	1	1	110	0	0	.....	.....	.....	.....	.....
Schuylkill Valley	15	10	6881	5	3192	.....	.....	.....	.....	.....
Upper Susqu. Val.	5	3	2572	2	950	.....	.....	.....	.....	.....
Lower Susqu. Val.	10	10	6217	0	0	.....	.....	.....	.....	.....
Lebanon Valley	13	11	8289	2	934	.....	.....	.....	.....	.....
Pittsburgh	29	28	62575	1	2458	.....	.....	.....	.....	.....
Spiegel	1	1	2638	0	0	.....	.....	.....	.....	.....
Shenango Valley	15	14	18253	1	1380	.....	.....	.....	.....	.....
West'n Pennsylvania	19	15	16098	4	1940	.....	.....	.....	.....	.....
Spiegel	1	0	0	1	1000	.....	.....	.....	.....	.....
Maryland	4	3	4472	1	175	4	1	116	3	440
Spiegel	1	1	814	0	0	.....	.....	.....	.....	.....
Wheeling District	11	11	14184	0	0	.....	.....	.....	.....	.....
Ohio:						8	1	87	7	475
Mahoning Valley	13	13	20823	0	0	.....	.....	.....	.....	.....
Central & Northern	11	11	18934	0	0	.....	.....	.....	.....	.....
Hocking Valley	2	2	875	0	0	.....	.....	.....	.....	.....
Hanging Rock	12	10	5832	2	230	.....	.....	.....	.....	.....
Illinois	14	14	24759	0	0	.....	.....	.....	.....	.....
Spiegel	2	2	1927	0	0	.....	.....	.....	.....	.....
Minnesota	1	1	900	0	0	.....	.....	.....	.....	.....
Wisconsin	4	3	3037	1	1020					
Missouri	2	1	900	1	850					
Colorado	2	2	225	0	0					
Virginia	21	17	10045	4	2278	4	1	48	3	290
Kentucky	5	4	1502	1	650	3	0	0	3	200
Alabama	37	27	22479	10	6600	5	3	909	2	160
Mich., Mo. and Wis.	.....	.....	.....	.....	.....	16	10	3989	6	2688
Tennessee	12	9	4372	3	1290	7	5	1020	2	200
Georgia	1	0	0	1	450	3	2	482	1	200
North Carolina	2	1	68	1	352	.....	.....	.....	.....	.....
New England	.....	.....	.....	.....	.....	11	3	274	8	730
Texas	.....	.....	.....	.....	.....	4	2	383	2	600
Utah	.....	.....	.....	.....	.....					
Oregon	.....	.....	.....	.....	.....					
Totals	315	264	285596	51	30669	80	29	7407	51	6748

SUMMARY.

Fuel.	In Blast. Number.	Month Previous.	Year Previous.	In Blast. Weekly Capacity.	Month Previous.	Year Previous.	Out of Blast. Number.	Month Previous.	Out of Blast. Weekly Capacity.	Month Previous.
Charcoal	29	32	16	7,047	8,004	4,330	51	48	6,748	6,473
Coke and Anthracite	264	264	175	285,596	290,010	223,865	51	52	30,669	31,626
Total	293	296	191	292,643	298,014	228,195	102	100	37,417	38,099

*Condensed from the *Iron Age*.

The Ideal Gas Engine Co. has made application for a charter from the commonwealth of Pennsylvania. The plant is to be located at Beaver Falls, Pa., and $50,000 will be spent in its erection. The charter will authorize a capitalization of $90,000, however. The engine to be built has been perfected during the past six years by Arthur H. Neale and either gas, gasoline or coal oil can be used for fuel. The officers of the new company are to be Ross P. Houston, president; Timothy French, vice-president; A. H. Neale, superintendent; Peter J. Edwards, secretary and treasurer.

It is stated that the Maryland Steel Co., of Sparrow's Point, Md., has received an order for 1,500 tons of rails from the Metropolitan Railway Co., of London, Eng.

David A. Clark, a resident of Maryland and a stockholder in the Keystone Axle Co., whose plant is located at Beaver Falls, Pa., and whose product consists of steel car axles, made application in the Allegheny county courts this week, for the appointment of a receiver for the company. The office of the company is in Pittsburg, and its capital stock amounts to $200,000. Clark alleges that the plant has been operated only intermittently since its erection and at a loss to the stockholders.

PITTSBURG FOUNDRYMEN'S ASSOCIATION.

At the meeting of the Pittsburg Foundrymen's Association held Wednesday evening, March 7, the following communication from Dr. Edward Kirk was read and received:

"*To the Pittsburg Foundrymen's Association:*

"GENTLEMEN:—When visiting foundries in different sections of the country I have learned that but a small percentage of them employ chemists, and the reason is largely found in the system adopted by the advocates of chemistry, in placing the matter before the foundrymen. This has been done upon the theory that it is only necessary for the founder to have an analysis of his irons to enable him to produce castings of any degree of hardness, softness and strength desired, which in many instances has not been the case. This system seems to me to be entirely wrong and certainly has been productive of prejudice against the employment of chemists in foundries. By this system the founder is compelled to make his mixture from analysis, something in which he is not experienced and is responsible for results.

"The question that many founders have asked is, 'Why should we employ a chemist when we have the same work to do and responsibility as without one and no greater certainty of results?' It is a well established fact that the quality of an iron may greatly deteriorate when melted in a cupola by improper melting, and the result indicated by analysis may be entirely destroyed in this way. With the present system the science of chemistry is placed entirely at the mercy of the melter, who can destroy its aim at will, and who frequently does destroy it through ignorance of the proper management of a cupola or prejudice against chemistry. To relieve the founder of responsibility in mixing irons and to make the chemist of greater value to him, and also to place the latter in a position independent of the melter, and make him master of his science, I propose that a chemist be given full charge of the mixing of the iron and of the cupola and melter, and that he be held responsible for the results of his analysis at the cupola spout. To prepare the chemist for the work, I propose that a course of pracitical foundry chemistry be established by colleges and scientific schools giving a course of metallurgy, to combine this with mechanical training that will make the chemist a practical melter, and an expert on cupola management as well as a chemist. I further propose that when he is employed in the foundry, he be given full charge of the cupola, and the mixing and melting of the iron.

"I do not propose that the chemist do the laborious work of melting, but that he be given charge of the cupola and the melter with the authority to discharge the latter if he does not follow his instructions in the cupola management. By this system the cost of melting in many foundries could be reduced to such an extent as would more than pay the salary of the chemist. The results achieved would be more satisfactory melting and better castings. There would be an inducement to the founder to employ chemists and more advancement would be made in foundry chemistry in one year than has been made in the last 10 under the present system.

"I desire to place this matter before the foundrymen's associations for their consideration, as a practical means of increasing the employment of chemists in foundries."

An animated discussion followed the reading of the paper. A number of the foundrymen strongly asserted their opposition to the employment of chemists in their plants for the reason that chemists are not acquainted with foundry practice and are often at sea when called upon to make an analysis of iron and indicate the results that will be produced when different brands of iron are used in various proportions.

Dr. Moldenke championed the cause of the chemists, arguing that the chemist should be taken into the foundry and should be taught the methods in vogue, so that at some later date his scientific knowledge of irons could be of use to the foundryman. He favored giving the chemist full charge of the cupola as well as the mixing of the iron, but he did not believe that he should be clothed with this authority until after he had proved his usefulness, and had become conversant with the foundry practice.

E. A. Kebler then cited an instance that came to his notice of the employment of a chemist. He said that a certain foundry had been newly placed in operation. A chemist was employed at the behest of the president of the company. When the chemist was introduced to the superintendent the latter asked him what he knew about foundry practice and the various kinds of iron that enter into various mixtures. The chemist replied that it was all foreign to him and he frankly acknowledged that he knew nothing about making the mixtures. The superintendent went directly to the president and said that the chemist would be of no use to him; but the head of the company still had faith in the scientific man and told the superintendent to teach him matters that he was unfamiliar with. After a month's experience the chemist began to get an inkling of what the foundry work was and some of his analyses began to prove useful. Shortly afterward a carload of iron was received at the foundry, which had a lustrous color, and the superintendent was congratulating himself on getting such good material. He told the president that he was particularly fortunate in securing such a good grade of iron. A sample was given to the chemist to analyze and he found that the iron was not what the superintendent believed it to be. In fact, he found it to be of very inferior quality and very hard. He told the superintendent that he had better go slow about using it as he found it to be very hard. This is where the superintendent had a grievance. Right here his knowledge of irons by fracture and color clashed with the knowledge gained by the chemist by analysis. He went to the president with his grievance and told him that he believed the chemist did not know what he was talking about. A pig of the iron was used with other components of the mixture and the casting made therefrom was found to be very hard, just as the chemist predicted. The superintendent was forced to acknowledge that the chemist was right, and gave the latter a little more leeway. Shortly afterward another carload of iron was received, which the superintendent immediately pronounced very poor. The chemist however analyzed it to be particularly good, and the castings made therefrom were found to be the best ever turned out. Mr. Kebler said that now the chemist and the superintendent work together with the result that very fine castings are produced.

After the discussion a committee was appointed, consisting of Wm. Yeagle, Thomas D. West and W. B. Rodgers, to consider the report and to bring the matter to the notice of the American Foundrymen's Association at the next annual convention.

President J. S. Seaman, of the national body, reported that the convention would probably be held in Chicago. Boston foundrymen served notice at the last convention that they would like to entertain the foundrymen this year, but it has since been learned that next year would be more agreeable to them.

The Chicago Machinists' Strike.

The strike situation at Chicago is unchanged. The men are still holding out for their demands, as given last week, and the employers still refuse to grant them. Strikes have been called in a few more shops since last week, but nearly all the shops of the city are running steadily, although one or two of them are shorthanded. The machinery manufacturers expect to secure all the men necessary to run their plants successfully, and are in much better shape to stand a long siege than are the strikers, who, as a rule, have very little money ahead, and very little credit at retail shops, and are getting very little help from their union. At the works of the Link Belt Machinery Co., 39th st. and Stewart ave., Chicago, a fight took place between strikers and non-union employes of the company, in which several men were hurt, one of them seriously. H. K. McLain, superintendent of the company, was hurt severely, and had to be taken to his home. Some trouble was experienced also at the works of Chas. Kaestner & Co., on South Clinton st., but no one was hurt.

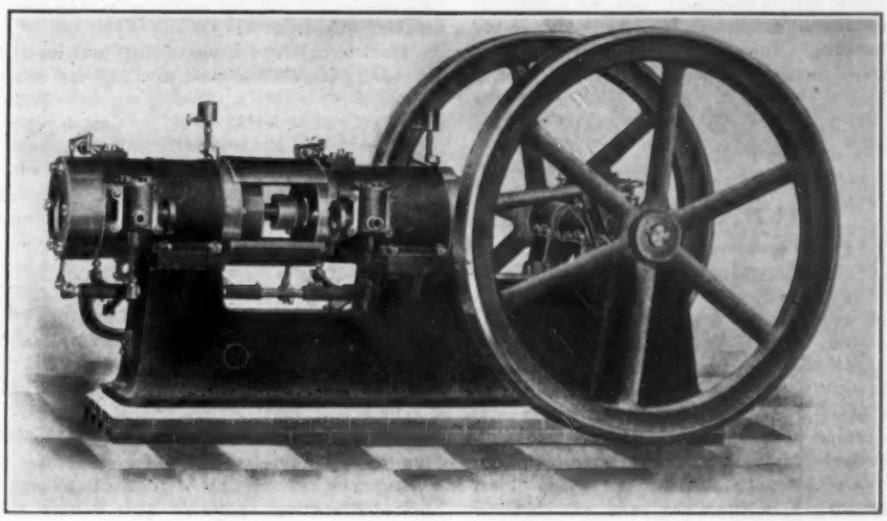
JAMES W. PEARCE and Alfred E. Pearce, of Cleveland, have formed a partnership under the firm name of Lord, Bowler & Co., and will continue the business as the successors of the former partnership of Lord, Bowler & Co. Wm. Bowler, of the old firm, sold his interest in it and in the Cleveland Elbow Co. to James W. Pearce on Jan. 1. Both partnerships are continued by the Messrs. Pearce.

TANDEM GAS AND GASOLINE ENGINE.

The tandem gas engine shown in the illustration below is manufactured by the Northern Engineering Works, of Detroit, Mich. It differs in general design from the single cylinder horizontal engine so commonly known. There are two single acting cylinders placed tandem, each cylinder operating alternately on the "four cycle" principle. This secures a "two cycle" effect, or an impulse every revolution as compared with an impulse every second revolution in the commonly known single cylinder engine. Thus it is claimed that all the economical advantages of the four cycle engine are retained, but with better regulation, with clean explosive mixture and with better results in other ways. The impulses are given with twice the frequency and with half the force of those in the single cylinder engine. Thus there is steadiness and uniformity of speed, which adapt the engine to electric lighting and similar duty. As the force of each impulse is half as great as that of the one cylinder engine of corresponding power, the resulting reaction is also only half as great, yet the weight is equal to that of the average single cylinder engine, insuring a strong machine.

Engines of 15 h. p. and under are readily started by hand. Above this size an improved pneumatic self-starting appliance consisting of an air compressor and receiver, is used which enables one man or a boy to start the engine quickly and without any of the risk attending the use of a mixture starter.

The number of working parts is few. There is but one crank, one connecting rod and one piston rod. The bed plate is deep and no parts are encased to cover details. The improved adjustable igniter is of either the "magnet" or the battery type. The operating mechanism of the electrodes is outside of the cylinder for instant adjustment or inspection, only the sparking electrodes being within the cylinder. The governor is of the sensitive high speed type. It regulates the consumption of gas or gasoline in nearly direct proportion to the amount of power developed under varying loads, and secures a very close regulation. The speed may be adjusted while running. An improved gasoline feed pump attached to the engine frame and driven from the crank shaft secures a positive feed. When gas is used an adjustable feeder valve is attached and is connected with a gas bag. Both feeding devices can be supplied, permitting of ready change from one fuel to the other. These engines are made in horse powers ranging from 10 to 60 actual and from 12.9 to 71 indicated. The manufacturers show a large list of these engines in satisfactory use in a large variety of duties.



TANDEM GAS AND GASOLINE ENGINE.

The Sharon, Pa., works of the National Steel Co., have been closed down during the past few days for the purpose of making repairs.

INCREASE IN WEIGHT OF MALLEABLES IN ANNEALING.

To the Editor:

Replying to Dr. Moldenke's criticism on my paper that appeared in your issue of the 8th, I wish to say that the castings mentioned in Table No. 1 were made from a mixture containing pig iron only; their total carbon was therefore higher than that of the bars mentioned in Table No. 3 which were made from a mixture containing 30 per cent of sprue and scrap. The castings were kept at an annealing heat four days for the first anneal, and at so high a temperature that the packing caked. These castings were of irregular shape and on this account it was out of the question to give exact carbon analysis. The thickest part of the castings was 3-16-inch and the second annealing was given to see if there was a gain in the weight after practically all the carbon had been removed. As to Dr. Moldenke's criticism of the carbon analysis, I stated in my paper that the sample represented the entire cross-section of the bar. The method employed was to break the bar and then to file across the broken end, the bar being held in a vise and the filings collected on a large paper held underneath. I much prefer this method to drilling, as I believe a more homogeneous sample can be obtained.

As to the gain in weight: An examination of Table No. 3 will show that the largest gain was on the ⅜-inch bar. I think that even in a jobbing foundry running on light work ¼-inch would come nearer representing the average cross-section of the work, and on the bar of this thickness the gain was 3.77 per cent. When we come to heavy castings such as couplers and other railroad work running for example from ½-inch to ¾-inch, we have a gain as shown in Table No. 3 of about two per cent. I should state that the bars were kept at a moderate annnealing heat three days. I have been told that it is the general practice in the Central West to anneal from one to two days. If this is a fact, I believe it is a shorter time than is the general practice in the East and it is a reasonable inference that castings annealed under such conditions would show a smaller increase in weight.

Now as to what causes the increase in weight. Both Stead and Royston writing in the Journal of the British Iron and Steel Institute bas shown that there is oftentimes a small amount of oxygen in the outer skin of a malleable casting. I have not a copy of Mr. Stead's original article (Jour. Cleveland Ins. of Eng.) before me, but if I remember correctly his analysis referred to a scaly casting. This scale, which was .012-inch in thickness, consisted of iron and crystals of silica. He stated that the silica was in the same equivalent proportion as the unoxidized silicon in the center of the bar. As this bar was ⅜-inch in diameter, it is evident that the proportion of oxygen present in the scale was very small. Royston speaks of finding a considerable amount of oxygen

in the outer layer, but does not say how much or what proportion of the entire bar this layer represented. I have never been able to detect enough oxygen to account for more than an insignificant proportion of the gain in weight. One question arises: If no iron from the packing is reduced and welded on to the castings, what becomes of all the scale and iron or steel turnings that are used. Many malleable concerns have been buying scale for years and have no more on hand now than they had some years ago. Of course, there is a trifling loss in handling, but I don't think this would account for the disappearance of so much scale.

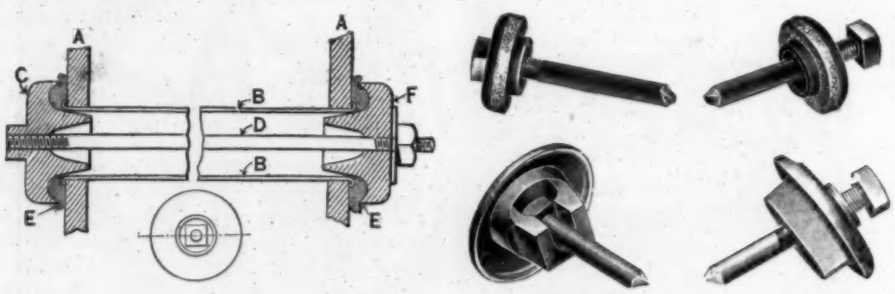
As to the "white crystalline rim" that Dr. Moldenke speaks of: These bars did not show it, except, of course, on one side where the metal was compressed by bending them in order to break them; but it was not a white edge such as is caused by too low silicon or too high sulphur in a casting. As to the diffusion of sulphur in this case the packing contained much more than the casting and naturally the latter gained by the diffusion. If we had a case where the packing contained less than the castings, it is reasonable to infer that the latter would lose.

Allow me to extend my thanks to Dr. Moldenke for his article, and I trust we shall hear more from him about malleable iron. GEORGE C. DAVIS.

Easton, Pa., March 10.

THE BETTERMANN FLUE PLUG.

Leaky flues, the bane of firemen and engineers, stationary, marine and locomotive, can be effectually stopped, according to Reinhold Bettermann, of Johnstown, Pa., by the use of his improved boiler flue plug. The method heretofore generally employed in the boiler room to stop leaky flues is to drive a soft iron plug at each end of the flue. It is generally driven in flush, and can rarely be gotten out except when blown out by internal pressure, as is often the case, endangering the lives of those working about the boiler, or by driving it out to the detriment of the boiler heads.



THE BETTERMANN FLUE PLUG.

The Bettermann plugs consist of two caps, which fit snugly on each end of the flue, and are connected by an iron rod. The smaller plugs, ranging from 1 to 2¾ inches are connected by a rod which has on one end a square bolt head and on the other end a thread. The iron bar is then passed through the flue, the square bolt head holding the cap at the one end and as the cap is adjusted at the other end, the nut is put on and tightened. Asbestos washers soaked in linseed oil are placed on the plug to insure a tight fit. The larger plugs, ranging from 3 to 6 inches, are adjusted on the same principle, with the exception that the one plug has a pocket on the inside in which the square bolt head is held while the other plug is tightened on by the nut at the end of the iron rod. The plugs have been made to fit any size boiler made, and the rods to connect the plug of course, can be made to fit any length of flue.

The inventor claims for these plugs that no amount of internal pressure will blow them out and furthermore when they are to be removed for the repair of the flues, they can be taken off as readily as they were put on. In addition, they can be used repeatedly and can be adjusted on very short notice.

Officials of the Wm. Cramp & Sons Ship & Engine Building Co., of Philadelphia, pronounce untrue the story that the firm is in any way interested in the project for the establishment of a blast furnace at Collingwood, Ont.

SCIENTIFIC METHODS IN THE FOUNDRY.

Mr. West Comments on His Experience in the Use of Analysis.

TO THE EDITOR:

In my article of February 23, 1900, I suggested a plan that would test the ability of anyone to judge the grade of pig iron by fracture, and challenged Dr. Kirk to accept it. He evidently did not expect the issue to be raised in such a practical form when he wrote his original article, and now, instead of meeting it squarely, so that it may be determined who is right, he fills a column of space with an evasive reply. He does not claim that the plan I suggested to test expert judgment of iron by fracture is impracticable, but he sidetracks the issue by reference to a college training of chemists for foundry work. While referring to the subject I would state that for some time past I have had under way a work on foundring, for colleges. If I live to complete it I believe it will prove of value to all colleges in teaching the mechanical engineer and others the principles involved in the three branches of molding, which include green sand, dry sand and loam work; also the essential connected with the cupola and mixing of metals, which latter will give the chemist all that I think it practicable for him to grasp, before entering actual foundry practice. The very first question that must be decided by any who would fit themselves for the making of mixtures of iron is whether they can place any confidence in the appearance of fracture, or whether they must depend upon analysis. This is the A B C of this work and must be learned before we can advance to any practical results in making mixtures.

The Doctor in speaking of the practicability of applying chemistry to foundry work, says: "And while all are willing to adopt anything that will give greater certainty of results, many are skeptical of results to be obtained by mixing iron by chemical analysis. This I have found to be due largely to the experiences of founders who have employed chemistry and made a complete failure of mixing irons by analysis." The above failures are not due to the incompetence of chemists, but to the founder's inaptness to advance himself in the work that those more enterprising have mastered. Let me say that I can take almost any foundryman, and in from one to two hours of instruction put him in a position to make a success of mixing metals by analysis, as well as show him that all he requires of the chemist is to give him correct analyses. To test the chemist's ability to do this he should use the American Foundrymen's Association's standardized drillings.

I would suggest to the Doctor that if he is anxious to assist in advancing foundry practice, he will see that a copy of this article is in the hands of all who he claims made a failure of chemistry, and I am sure if they will call upon me some evening they will not regret the money spent for their trip. The information would be given freely and without charge. I would show by illustration how to operate a cupola and guard against evils that might change intended results.

The Doctor further says that "Mr. West makes a specialty of heavy castings, for which only one grade of iron is required," intimating that I am not in position to have any knowledge of the requirements of work or analysis in other specialties, or in general jobbing foundry work. He may search the country over and be unable to find castings, with the exception of chilled rolls, that are subjected to any severer test, or that leave less room for divergence from a

required standard than the heavy castings made by our firm. If we practiced mixing of irons by fracture, we would be bankrupt in a very short time. During the seven years that we have worked by analysis we have had no bad work where the analyses were correctly reported. We have gone along for several years at a stretch with such uniform results in heats, ranging from 70 to 90 tons daily, that it was rare for the chippers or any one to notice the slightest change in the hardness or softness of the castings when cleaning them. On the other hand, when we followed the practice of judging by fracture hardly a week would pass without the widest extremes in hardness or softness of the castings. Dr. Kirk, in ignorance of the requirements of our work, states that we use "only one grade of iron." We often require two to four different grades, according to the thickness of the varying sizes of castings. Again, in varying our mixtures to obtain what we desire for the different thicknesses of castings, we have to accept all kinds of different grades, so that instead of its being an easy thing for us to make our mixtures, I know of no specialty or general work, outside of chilled rolls, that requires any greater experience and skill in making mixtures. This all our competitors can verify if called upon. It is in such work as ingot molds, chilled rolls and car wheels that the founder of today soon sees the impracticability of judging pig iron by fracture and appreciates that the chemist's place is in his laboratory, leaving the foundryman responsible for results of mixtures.

In setting up general foundry work, as requiring the highest skill in working by analysis, Dr. Kirk shows again his entire lack of acquaintance with the subject. In general founding there is considerable leeway allowable in the grades of iron employed, for as a rule castings, aside from chilled rolls, ingot molds and car wheels, permit of a great variation in their physical qualities while still passing inspection and rendering good service. If some of the founders doing the general work cited by Dr. Kirk were held down to the exacting limits demanded by the three classes of products mentioned, there would not be such ignorance displayed as appears in some lines of this subject. I am not surprised that the Doctor is anxious to quit this controversy, for anyone carefully reading his article of March 1 will see that he would now like to disavow ever having claimed the ability of experts to make infallible judgments of pig iron by fracture. THOS. D. WEST.

Sharpsville, Pa., March 5.

Larger Latitude Advocated for the Foundry Chemist.

TO THE EDITOR:

The articles which have appeared in the recent issues of *The Iron Trade Review* over the names of Messrs. West and Kirk, seem to be at an end and must be added to the vast accumulation of literature on the subject of foundry chemistry. The point on which they seem to differ is the proper position of the chemist in foundry work.

That the chemist's present position, in most cases, is not the correct one is proven by the fact of so much discussion as to the real position he should occupy. There are no controversies in regard to the position of a foundry foreman, or engineer, or any of the other positions about the place, as to the real duties of each or by what bounds they should be limited. These points have long ago been established, and probably never were in much doubt. But with the chemist an entire different state of affairs exists. His duties and work at one foundry are entirely at variance with those of his brother chemist at another place. In visiting different establishments and inquiring for the chemist, you are directed in one case to the foundry as the place in which he could most likely be had. At the next plant you are conducted to the laboratory where he is constantly engaged making a certain number of determinations a day in a given number of hours. In one place his field and duties are bounded by the walls of the laboratory, in another they had been extended to include the foundry, and especially the cupola. That the latter plan should prove more profitable and expedient is the opinion of the writer.

Don't understand me that all chemists employed at foundries should be given liberty and authority at the foundry and cupola; but the writer does hold that a man to be a "foundry" chemist (and this is a recent branch of the chemist's art) should be treated with more confidence and his advice considered to a greater extent than is the custom in most places at the present time. At some foundries he is told to make mixtures with irons bought by clerks and book-keepers, who know not whether the iron can be used in small or large percentages, and is then taken to task for not using more of this particular iron in the mix, because the salesman said it would be possible to carry 25 per cent. while 10 per cent caused a bad casting. A person who has had training in practical founding, together with a course in metallurgical chemistry, is justly entitled to the name of a foundry chemist, and such a training if given by our technical schools would certainly come closer to the solution of this question. This person should not be expected to do all the routine work in the laboratory any more than the chief chemist in any metallurgical laboratory, but he should be able to apply the results and when trouble is experienced in any quarter, to know what determinations are necessary to locate successfully the cause.

Instances have been known in which the iron was bought, mixtures made and the bars tested without any part therein being taken by the chemist. The latter simply checked the iron on its arrival, and reported to the management, the mixtures being made and the iron tested by the foundry foreman alone. It can easily be seen that the greatest good was not to be had from this arrangement. Yet this establishment dispensed with the chemist and his laboratory, condemning it as not tending to the successful operation of a foundry. In a few cases in which chemistry has been looked upon with some skepticism, either this attitude was due to a trial similar to the above mentioned, or to the incompetency of persons engaged in the work. With a man of practical foundry and cupola experience, and a knowledge of foundry chemistry, the best results can be attained to the satisfaction of all.

FRED. W. BAUER.

Jackson, O., March 9.

Obituary.

Addison C. Rand, president of the Rand Drill Co., and well known throughout the country in engineering circles, died at New York, March 9, aged 58 years.

Samuel T. Williams, superintendent of the National Steel Co.'s steel plants at Mingo Junction and Bridgeport, O., died March 12 of pneumonia, aged 46. He had been manager of mills at Portsmouth, O.; Johnstown, Pa.; Troy, N. Y.; Philadelphia, Pa.; Muskegon, Mich., and New Philadelphia, O.

George A. Evans, for many years sales agent of the Bethlehem Iron Co., died on the 6th inst., aged 67 years.

A $6 Puddling Rate.

A conference was held at Youngstown, O., March 8, between Secretary James H. Nutt, of the labor bureau of the Republic Iron & Steel Co. and a committee headed by Secretary John Williams, of the Amalgamated Association. The examination of the statements sent in by the various concerns, sworn to by the manufacturers, showed that the average selling price of bar iron in January and February, on which the wages of the puddlers and finishers are based, was 2 cents. This entitles the puddlers to an increase of 25 cents a ton, making the puddling rate $6 per ton, and an increase for the finishing departments of 4 per cent. In January the puddling rate advanced to $5.75. Previous to July 1, 1899, it was $4.50. The advance in eight months is thus 33⅓ per cent.

THE American Ship Building Co., of Cleveland, O., (the consolidation of lake yards) has been asked to make estimates upon the construction of two new passenger steamers for service between Buffalo and Detroit. Wilbur E. Houpt and John Gordon, of Buffalo, are back of the project and it is proposed to construct vessels 470 feet in length over all, 50 feet beam and 29 feet molded depth, with triple expansion engines of 4,000 h. p.

F. M. Conley, of the Winslow Automobile Co., of Philadelphia, Pa., has purchased the plant of the Doylestown Agricultural and Lenape Bicycle Works, at Doylestown, Pa., with the idea of enlarging it and utilizing it for the construction of automobiles. It is expected that 300 hands will be employed.

ANALYSIS IN THE FOUNDRY.

BY STUART B. MARSHALL.

The value of silicon in iron for foundry use has undoubtedly been overestimated, for some seem to think it to be the one element which makes iron soft and saleable; whereas it is a softener and hardener under different conditions. Too much silicon in the iron will certainly make it weak and will often cause shrikage and drawing in castings, similar to sulfur. It will be of very little value in any iron unless there is enough total carbon in the mixture, for it seems to have the property of creating graphitic carbon and thus, under certain conditions, having indirectly a softening influence. This is why the name softener is used for irons having such a large percentage of silicon, but as is well known by most foundrymen you must not use too much or it will have just the opposite effect. For large castings, plates, etc., it is a great mistake to have too much silicon in the mixture, for they will be weak and porous. A moderate amount of silicon in pig is very desirable, and for most kinds of castings 1.30 per cent to 2.00 per cent is about right. Of course, if small castings which are to be machined, are desired, then it is best to use a higher silicon iron, but it must be done with care. In our cupola at Dunbar we have used an iron containing 1.45 per cent silicon with great success on a variety of castings, and it will carry considerable scrap also. We have used foundry iron containing .90 per cent silicon for larger castings and it worked all right. Of course, the sulfur was low in these irons and the carbon well up. So often the iron gets blamed for being hard, when in reality it has been caused by too much blowing, which simply blows out a great percentage of silicon and increases the combined carbon, also decreasing the graphitic carbon content; so the foundryman asks for a higher silicon iron, when, by proper attention, the iron he has will work all right.

Sulfur is a very undesirable element in foundry work, and the pig used should have a low percentage of it, always under .050 and preferably under .035, because an excessive amount of sulfur causes "red shortness" and shrinkage. Of course, the coke and scrap are to be considered more when it comes to looking up the sulfur, as the former will run about 70 per cent and upwards, sometimes very much higher; and the scrap is liable to run almost any percentage of sulfur, very often being as high as .15 per cent and over. There is hardly any more injurious element in foundry practice than sulfur, and while it will make iron hard and cause it to chill, if you desire that kind of casting, the result can be secured by reducing the silicon content and by more blowing. You can get a harder iron by increasing the combined and reducing the graphitic carbon. Sulfur more than any other element is the cause of so many complaints and one ought to be very careful as to the quality and quantity of scrap used. This precaution also applies to the coke. The pig should be tried alone with the coke so as to find out just where the trouble occurred. An excessive amount of sulfur seems to cause an increase in combined carbon with a decrease of graphite, which gives you hard castings, thus making them difficult to machine, showing how largely the low sulfur and high graphite content in foundry pig enters into the question of softness.

The importance of graphitic carbon in a foundry mixture can hardly be overestimated. A proper amount of that element is necessary so that the iron will run well, and be easily poured. A good percentage of graphitic carbon and low sulfur — and they usually are associated that way—are the first essentials of a good soft iron. And when they are in the pig in the proper amounts, the silicon does not cut so much of a figure, as you can make castings which can be easily turned, without so much silicon, and thus get a stronger and more homogeneous one; for too much silicon will make the castings dirty, too open and weak. From 3 per cent to 4 per cent is a good amount of graphite for foundry iron, and one must remember that old burnt scrap will work just the opposite way, and if used must be mixed properly. A great amount of scrap can be used if attention is paid to the mix and one appreciates the variety of castings which are to be made; for what is good in one case will not work at all in another. Graphitic carbon seems to be the element, more than any other, which makes the pig and casting soft and easy to bore. It also favors fluidity and easy pouring.

Combined carbon seems to make the iron harder, more brittle and difficult to bore. It should be under .50 per cent in foundry iron unless very hard castings are needed or class of work being made which is to be very close and not to be machined. Even when the pig is not high in combined carbon, excessive blowing will create it in the mix at the expense of graphitic carbon, and I have seen good soft iron condemned just because the foundryman was blowing the silicon and graphite out of the mix and increasing the combined carbon content. The resultant was a hard casting, about as hard as steel, which could not be turned or filed. In this case the loss of some silicon could have been borne, if the graphite had remained the same.

Phosphorus is supposed to make the iron more fluid, if present in a noticeable amount, and it certainly does by reason of being a heat agent, but you can get fluidity with a low phosphorous iron by having a reasonable amount of silicon along with high graphitic carbon and low sulfur content. For certain kinds of castings, where the iron has to run into small spaces, and for thin castings where there will be a considerable time consumed in pouring, it is well to have increased percentage of phosphorus, but when you have more than 1 per cent in the pig it makes it weak and one must look out for "cold shortness." It is better, in general practice, to keep the phosphorus under .75 per cent in the pig, as you will have a much stronger iron.

A moderate amount of manganese in the pig will not be harmful for castings, but it is well to keep it under .75 per cent for, like sulfur, it will cause hardness, and unless you want that or chill then it is not necessary, for it will simply make the castings so hard that they cannot be machined. Sulfur has quite an affinity for manganese, and the presence of manganese also seems to favor the formation of graphite, under certain conditions only; because in the presence of high manganese I have seen the graphite reduced somewhat.

A brief summary of the above shows that conditions cut quite a figure with the elements in pig iron for castings. A foundryman should not condemn an iron until he has investigated the scrap, coke, the mixing and blowing, for very often the one thing he might pass unnoticed will be the one to cause the trouble. Too much silicon, sulfur, manganese or combined carbon will make the iron hard. Too much phosphorus makes it weak, so if strength is desired, a low phosphorus is necessary. For heavy scrapping the silicon ought to be increased, but if there is not enough total carbon, it will be useless. As Mr. Pilkington said, in the paper recently reprinted in *The Iron Trade Review*, silicon and phosphorus are both hardeners and weakeners and do the work of the carbon at a cheaper cost. Grading by chemical analysis should be the only true selling guide, and while it does not yet seem to have been perfected, yet a scale made up on the silicon, sulfor and graphite contents ought to help the matter considerably. There is no use going by fracture because it will mislead you as often as it will help, and this will be especially true of iron made under abnormal conditions.

I have seen iron with only .50 per cent silicon break with a beautiful No. 1 fracture and then again a 2.50 per cent silicon iron break with only a mill fracture. Both irons were under .030 per cent sulfur and over 3 00 per cent graphite. I have also seen men who judged by fracture pick out the very worst foundry iron on the yard just because to their so-called experienced eye it looked better, when in reality it was not so. When you see the peculiar changes of fracture in iron of the same cast and also in the same bed, one had better take up a more modern and scientific idea and rely more on chemical facts, which have proved to work better than the "rule of thumb" way; when taken up intelligently. The foundryman should work more with the furnaceman and let him know of his needs, and also when the iron works all right. As it is the furnaceman only hears of troubles, which, if the matter had been gone into before, could very likely have been obviated.

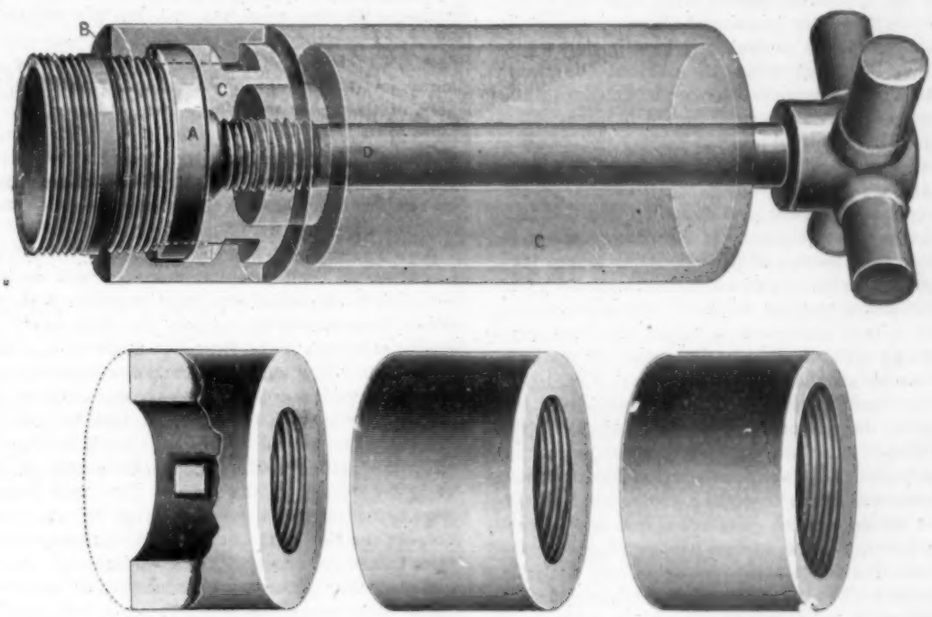
In conclusion I will give an experiment which I made to show up several of the points which have just been mentioned. Two irons were tried separately for about two weeks on radiator work which, as is well known, needs a very fluid

iron with littles shrinkage and a dense gray casting, which can be easily bored. The iron was charged in the cupola in the following proportion: 600 pounds pig and 400 pounds radiator scrap. The first test was with an iron of the following analysis: Silicon, 1.83 per cent, sulfur .026 per cent, phosphorus .301 per cent, graphitic carbon 3.17 per cent. The radiators seemed all right in every respect. The next test was made with an iron of the following analysis: Silicon 1.00 per cent, sulfur .026 per cent, phosphorus .261 per cent, graphitic carbon 3.09 per cent. The radiators were decidedly satisfactory, just as much so as in the first test, and the strange part was that the shrinkage was really less. In both cases the shrinkage was less than ⅛ inch to the foot. The iron ran fluid in both cases, but the radiator from the 1 per cent silicon iron was decidedly stronger and denser. Both were easy to bore.

Dunbar, Pa.

IMPROVED NIPPLE HOLDER.

Curtis & Curtis, of Bridgeport, Conn., are the manufacturers of the nipple holder shown in the illustrations. The drawbacks of cutting and threading a nipple in the ordinary way are well known to pipe-fitters. The slipping and squirming and jamming of the nipple make the operation well-nigh interminable. This new device for holding nipples is of



small diameter, can be used in a pipe machine and is capable of taking a large range of sizes. It does not require the use of a hammer or other tools. Fig. 1 illustrates the internal workings of the holder. A socket B of the proper size for the pipe to be held, which is shown in Fig. 2, is secured to the body C by a one eighth turn, and the screw D is run forward by a wheel. The nipple is then screwed into the socket as shown in the cut, but is so arranged that it bottoms on the plunger A before it jams in the thread and is thus held secure. To release the nipple, a part of a revolution of the screw D will allow it to be removed by the fingers. These holders can be used either in a vise with a common die stock, or they can be used with any of the pipe machines now in the market. To meet the requirements also of the common style of overhung spindle machines, the manufacturers have also adopted this same principle in a holder adapted for their use. The sockets are made in various sizes up to a capacity of eight inches but can be made to any required size.

An Open-Hearth Plant for France.

The Wellman-Seaver Engineering Co., of Cleveland, has closed a contract for engineering work for an open-hearth steel plant for the Societe des Acieries de Longwy, France. The Cleveland company will furnish complete plans and supervise the erection of the plant at Longwy. There will be six 40-ton furnaces, with a daily output of about 500 tons. The product will be billets, plates and bars.

One View of the Chicago Conflict.

In its last issue, the *Boiler Maker*, published at Chicago, refers as follows to the strikes in that city, in their causes and in their bearing upon the business situation in that important consuming center:

In the ever-recurring strifes between master and men, Chicago has been the acute center. These contests have culminated in loss of life and destruction of property, and the fearful railroad, stock yards and anarchists' riots are dark reminders. From these conflicts labor has always gained a little; at times recognition of the "unions;" and others, shorter hours or increased wages. But wherever a trade has improved its condition, it has created the very element to lessen its strength, for to its ranks have been added others of equal ability, but whose occupation offered lower wages or longer hours. This has made a competition, not of rate per hour, but duration of employment, so that the average wages received per year is but little, if any, more than under the old method, owing to the surplus of labor in the trades that pay the larger wages.

To counteract this the unions have decreed a limit of work to be performed by a man in a day. This has been gradually lessened, until in some callings it is half, and even a third of a full day's work. It has no justification, as it is based on the capacity and inexperienced or lazy men. Like attempting to maintain an artificial price, by limiting production, failure will be the same. Under this system the supply of labor somehow increases and the demand falls off. High wages or large profits equally find many seekers. We might speak of the side issues—the "business agents," a large number of whom hold city and county appointments; the "walking delegates," who meet the men as they open their pay envelopes, demanding a share of the weekly wages; of the fact that the president of the Amalgamated Trades Unions is also president of the civil service board, and thereby controls every minor officer of this city, be he policeman, clerk or laborer.

The crisis is at hand, and in its outcome every one in our land has an interest. The principle involved is the right of a man to do his best, without injury to his fellow. No change is asked in the short hours or high wages existing here, but in return the employers demand an equivalent of service and the right to select the industrious and skillful from the lazy and inefficient. The unions say "nay," the masters say "aye," and that is the issue. All this affects business here. It is a condition we prophesied months ago, when this present period of prosperity began. It is conceded by all fair-minded people that every wage earner is entitled to a share in the better times, but the trouble here is that each trade involved in producing an article wants all the advance.

MINE DAMS.*

BY JAMES MACNAUGHTON.

The necessity for building mine dams throughout this part of the iron district of Michigan has been of frequent occurrence. Especially has this been true at the Chapin mine, where the principal shaft is located in the limestone and where the greater part of the cross-cutting to connect this shaft with the ore body is through limestone. During the sinking of the shaft in question, viz., the Hamilton shaft, no water of any importance was encountered until a depth of 1,460 feet was attained, when a large water course was tapped which filled the shaft to within 80 feet of surface in less than 36 hours. The Ludington mine, adjoining the Chapin, encountered water in one of the lower levels near the limestone, which entirely flooded that mine. After these two mines had been flooded for two or three years, they were baled out, and it was found that the inflow was no greater than that previous to their flooding. This fact would indicate that the flow causing the flooding was from a large vugg or reservoir, and that when it was exhausted the inflow became normal.

In the first cross-cut from the Hamilton shaft to the Chapin ore body, which is 750 feet from surface, a water course was encountered, at a point south of the shaft in the limestone. This water when first struck, had a pressure of 276 pounds to the square inch, but by drilling several holes from the breast of the cross-cut into the water-course and allowing the water to flow, the pressure, after several hours, was exhausted. The breast was blasted, and it was found that the water was flowing out through a large hole or water-course in the bottom of the cross-cut. The normal flow from this point afterthe pressure was exhausted was 750 gallons per minute. The water-course was enlarged by removing all the loose rock for a depth of 18 feet, the water being syphoned out of the vugg back through the cross-cut and down the shaft to the pump, which was located at a point 580 feet lower down in the shaft. A horizontal section of the hole after being thus enlarged showed it to be about 7 feet 6 inches long by 5 feet wide. It was inclined slightly to the west. An extra heavy 10-inch pipe with 10-inch gate valve on uppet end was used in the vugg, through which to syphon the water. A platform was made with timber around the 10-inch pipe 17 feet below the bottom of the level. The cavity thus formed, from the platform up to the bottom of the level, was filled with a concrete composed of one part German Portland cement to two parts of sharp clean sand and four parts of broken limestone. Great care was taken in getting good contact beteen the concrete and the sides of the vugg. To prevent leakage between the concrete outside surface of the pipe and the concrete, the latter was not rammed tightly around the pipe, and the small crevices thus left were filled after each foot in height of concrete had been completed, with a mixture of equal parts of sand and cement. After the entire cavity had been filled, the concrete was allowed to set for a week before the 10-inch gate valve above referred to was closed. The entire flow of 750 gallons per minute was thus held back and in less than 12 hours the pressure on the valve had reached 276 pounds, or the same pressure as when the water was first encountered. On the second cross-cut from the Hamilton shaft, which is 960 feet from surface, water was encountered at the same distance south of the shaft, but at a point a little further east than on the level above. This water, like that on the first level, was struck while drilling, and showed a pressure of 355 pounds to the square inch. The flow of water at this point was stopped by plugging the drill hole with a pine plug through which was a pipe with gate valve attached. When the plug was firmly in the hole and secured by means of braces and yokes, the valve was closed.

It soon became apparent that the breast of the cross-cut was becoming weak, (there being less than two feet of solid rock between the breast and water-course); and it was decided to build a dam in the cross-cut 30 feet back from the breast to prevent any sudden inrush of water to the mine, should the breast of the cross-cut fail. This dam was made in the shape of a circular arch on its side, the arch being 6 feet thick and having a radius of 7 feet 6 inches. On the crowing side of the arch, concrete to a thickness of 5 feet was laid, this latter to act as a sealing device, while the stone arch provided the necessary strength. Local sandstone was used in the construction of the arch. A strong 3-inch pipe with gate valve on outer end extended through this dam, to carry away leakage from the end of cross-cut while the dam was being constructed. The mortar used in the construction of the arch consisted of one part of German Portland cement to two parts of sand.

When the concrete and mortar had been given a reasonable time to set, the gate valve was closed, thereby accumulating the leakage in the space between the dam and breast. As soon as this space became filled with water, the dam assumed the total load due to the height of water in the vugg. The total load on this dam amounts to 1,840 tons, or 25.26 tons per square foot of surface exposed.

In order to avoid the necessity of penetrating the watercourse encountered on this level, and also to reach by a more direct route a large ore body that was not known to exist at the time of starting the original cross-cut, a new cross-cut was started by branching off from the original one at a point some distance back from the dam last above described. When this opening had reached a point about the same distance from the shaft as the original one, only 150 feet further west, water was again encountered while drilling. This supply was found to have the same pressure as that in the other cross-cut in this level, viz., 355 lbs. per square inch. The efforts to stop the flow at this point did not meet with success. The breast of the cross-cut was badly broken up, many small openings or vuggs being exposed, although in none of them was there any water flowing. A plug 6 feet long, with pipe and valve, was forced into the drill hole. The valve was closed and the flow stopped, but only for a short time. The plug had not reached the bottom of the hole by two feet, and the rock separating the inside end of the drill hole from the exposed vuggs broke away.

As it was impossible to stop the flow of water from the vuggs on account of their irregular shapes, it was decided to build a dam in the cross-cut at a point 58 feet back from the breast. While preparations for starting this dam were being made, the large bailers in the Hamilton shaft were gotten ready for use. The flow of water at this point had subsided slightly, being now only 900 gallons, which in addition to the 600 gallon normal flow at this shaft made a total of 1,500 gallons per minute to be pumped. After the bailers were in readiness, an effort was made to still reduce the height of water in the vugg by increasing the area of flow, and two other holes were drilled, both of them penetrating the vugg. In this manner the flow was increased to 1,600 gallons per minute from this point, or a total for the pumps and bailers of 2,200 gallons. The pressure was reduced to 68 pounds per square inch. At this point both the pressure and the flow suddenly increased, the former rising to 102 pounds per square inch, and the latter to almost 1,800 gallons per minute. This would probably indicate the existence of a second or parallel vugg, which, by reason of the water being reduced in the first vugg, thereby weakening the intervening wall, broke through into the first vugg. During 12 hours the pressure gradually reduced to 80 pounds, when there was a repetition of the occurrence, the pressure rising to 127 pounds per square inch, and the flow increasing somewhat, although the amount could not be determined, as the last two holes drilled were immediately plugged, and work resumed on the dam. A temporary dam built of timber and sod was constructed near the breast. This raised the water 5 feet high and permitted its being carried in launders past the point at which the permanent dam was to be built.

All loose rock was picked from the bottom, sides and back for a length of 22 feet at the site of the permanent dam. After concrete to a thickness of 18 inches and for a length of 20 feet had been laid, an 8-inch pipe with gate valve, each capable of withstanding a pressure of 800 pounds per square inch, was placed centrally between the two sides, the pipe extending about a foot outside the dam at each end. Covering the inside end of the pipe was a screen, to prevent any of the sod or material incident to the construction of the temporary dam from clogging the pipe. A heavy wrought iron yoke was used to anchor the pipe into the concrete. When

*Read at the meeting of the Lake Superior Mining Institute, February, 1900.

the concrete had attained a height of 5 feet and had sufficiently set, the temporary dam and launders were removed, and the flow of water began through the 8-inch pipe.

When the concrete had reached a point about 9 inches from the back, it was discontinued. The remaining opening was filled with hard brick and cement mortar; first, because the concrete could not be properly rammed in so small a space; and secondly, to reduce the openings for cement as much as possible and thereby prevent excessive shrinkage. There seemed no question but that this dam would stop the flow of water, provided it did not move bodily, the total load when applied being in excess of 2,500 tons. As an extra precaution lengths of 70 pound rails were placed horizontally in the concrete with the flanges facing out and flush with the face of the concrete. The ends of these rails were cemented in hitches 6 inches deep in each side wall. Two steel girders 13 feet long and 32 inches deep, with 12-inch flanges, were placed vertically so as to give a perfect bearing to the face of the concrete and flanges of rails. These girders were so placed as to divide the face of the dam into three spaces of 3 feet 4 inches each. The girders were cemented into hitches 18 inches deep in the back and bottom.

In less than four weeks from the time the inside face of this dam had been completed, the valve was closed, provision having been made for the air existing between the dam and breast to escape through a small pipe leading to the highest point in the back near the dam. After all the air had escaped the dam seemed to assume the load suddenly, the hand on the gauge moving from 0 to 220 instantly. In six hours the pressure had reached 440 pounds, and in the course of two or three days this water resumed its normal pressure. It is a peculiar fact that the point at which water was encountered on the first cross-cut and the two points on the second cross cut lie in the same vertical plane. At each of the points the water when first struck carried large quantities of fine sharp sand, and although attempts were made by building temporary dams to provide for settling before pumping, a large quantity of sand passed through the pump, to which the valves and plungers can bear evidence.

CARNEGIE STEEL CO.'S ANSWER.

(Continued from page 10.)

with respect to his interest in both companies and the other by the other members of the association, the former of which was made for a cash consideration, of which $1,000,000 was paid by said Moore and $170,000 was paid in equal shares by Frick and Phipps; and the latter of which was made for a nominal consideration.

"According to the plan Carnegie was to receive $100,000,000 of the price mentioned as coming to him in bonds, and the balance thereof, about $57,950,000, in cash. It is not true, however, that Carnegie thereby attained any advantage over the other members of the association. He rather suffered a disadvantage because the options given by the other members provided for a payment to them entirely in cash or in securities at their option. The price fixed in said option was based upon the proposition that said Carnegie should go out and stay out of the steel business, but that the junior members should be employed by the proposed corporation for a term of years. Many of the junior members of the association were attracted by the scheme, which gave them the opportunity not only of future employment in the conduct of the business, but also of realizing at once upon a capitalization of their future earning power, and to comply with their wishes the defendant Carnegie acceded to the suggestion of giving the option and received his share of the price paid for the same. The parties to whom the option was given, however, when the time came to exercise it, were unable to carry out its terms and to provide the money needed to complete the purchase, so that when the option expired, the said Carnegie, seeing from a business standpoint the impracticability of the plans of the plaintiff and his associates, declined to modify or renew said option, and thereafter the plaintiff manifested in his relations to the said Carnegie, and in the performance of his official duties as a member of the board of the association, an increasing animosity toward the said Carnegie.

Symptoms of Discord.

"Prior, however, to said transaction, and as early as the month of March, 1899, the plaintiff caused to be spread upon the proceedings of the board of managers remarks made by him which tended to introduce controversy of a personal character into the business of the association. From time to time these insinuations and inuendos were spread upon the minutes with a more intense exhibition of feeling, and culminated in a formal paper which the said plaintiff introduced and caused to be spread upon the minutes of the meeting, in the month of November, 1899, which was calculated to destroy all harmony of action in the board. As a result of the plaintiff's attitude a large majority of the members, both in number and value, determined that it was necessary, for the protection of their interests as members of the association, as well as of the association itself, that the relations of the plaintiff to the association should be severed."

Mr. Frick Enforced the Iron Clad Agreement.

Mr. Frick it is claimed has upheld and enforced the so-called "iron clad agreement" at all times. During all the years he has been its chairman, Mr Frick, as the active agent of the association, has acquired the interests of all retiring partners under its provisions; when a partner was deemed unsatisfactory by his associates he was informed of that fact generally by Mr. Frick, with a statement that the company would pay for such interests under the terms of the agreement, and if not accepted voluntarily he would enforce said terms. This course continued up to the time of his resignation as chairman and manager of the association and he was the first to attempt to evade the agreement. It is asserted that under the terms of the iron clad agreement signed by Mr. Frick his interest has been transferred to the association and the association tenders payment for said interest according to the value as it shall appear on the books of the association March 1, 1900, and as soon as the books are written up as of that date the plaintiff will be furnished with a balance sheet and the cash and notes will be tendered him for the value of his interests, said amount being approximately $4,900,000. It is averred that the said sum is the full amount due Frick. The valuation being upon the same basis as all other settlements, with partners and with estates of deceased partners.

During the membership of plaintiff in the association, in addition to an adequate salary paid him for services as manager, he received upon his said interest actual dividends in cash, which not only repaid him the sum of $310,000 which he himself paid for his interest, but an additional sum or clear profit of $938,275.87. The book value of said 6 per cent interest Jan. 1, 1900 was $4,536,606.24, to which will be added in settlement his proportions of the profits earned during January and February, and the defendants say that the plaintiff has no reason to complain of the operation of a contract which gives to him nearly $5,000,000 for an interest which involved no investment of capital by him, and which has already paid him, in cash, profits of almost $1,000,000.

Arbitration Cannot Be Considered.

The proposition made by Mr. Frick to arbitrate the value of his interests is rejected because the defendants propose at all times to maintain the integrity of the contract under which the relations of the association and its various members have been defined since 1887, declaring if the validity of such an agreement cannot be maintained it will be impossible in the future for this association or others organized upon the same plan to continue in business, and by reason of the importance and necessity of maintaining the integrity and validity of the iron clad agreement the defendants decline and will always decline to arbitrate the question of the value of Mr. Frick's interests. They do not regard Mr. Frick's offer as being made in good faith nor as made for the purpose of obtaining what he is justly entitled to, but for the purpose of evading his agreement, and to obtain a price which he is not entitled to. It is denied that the association is under the exclusive control of Carnegie, but it is averred that if it is he is fully competent and able to properly manage and carry on the business.

The defendants admit that the business of the association was, while Frick continued a member, "jeopardized by inharmonious relations of partners" and it is necessary that

"its enormous business might be carried on by united and harmonious action," but they aver that there is no reason why the plaintiff should be permitted to repudiate or evade his own contract, fairly made, upon a fair and full consideration, which has heretofore been observed in good faith and without exception by all the other retiring members of said association, and which, until it was applied to his own case was always advocated and supported by the plaintiff himself, not only as a valid and binding contract, but as a fair and equitable one, and which the plaintiff himself has always nsisted should be impartially applied to the interests of the living and the estates of the dead.

The defendants aver that the Carnegie Steel Co. is still a valid partnership association under the laws of Pennsylvania, deny that it is a general partnership, decline plaintiff's proposition to take further action alleged or pretended to be for the purpose of making said company a partnership association, or to admit the planitiff in management of the business upon the pretense that the said company is now a general partnership. The defendants are advised and believe and therefore aver, that so far as the so called "iron clad agreement" is concerned, it is immaterial whether the said company is a partnership association under the statutes of Pennsylvania or a general partnership, and that in either case the said so-called "iron clad agreement" is a good and valid contract binding upon the plainitff with respect to his interest therein.

The defendants ask that the bill be dismissed with costs placed upon the plaintiff.

INDUSTRIAL SUMMARY.

[If you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

New Buyers in the Market, and Some of Their Wants:—

The Sandwich Iron & Steel Co. has been incorporated at Sandwich, Ill., with a capital stock of 50,000, for manufacturing merchant bar iron and steel, by B. Mansfield, Louis Burnstein and S. D. Newton.

The Underwood Machine & Supply Co., Sandusky, O., is in the market for a second-hand 16 inch engine lathe, a sensitive drill press and a 16-inch shaper.

The Laird Malleable Iron Co. has been organized at Huntingdon, Pa., and will engage in the manufacture of all kinds of malleable castings, Laird patent malleable snow and ice guards, roof gutter irons and improved eave trough hangers. The company has purhased the Gondola property in Huntingdon and have fitted it up to make 10 or 15 tons per day of malleable castings. On Feb. 14, a charter was granted the concern, the capital being $100,000, most all of which has been paid up. S. R. Hanpt, of Milton, Pa, is president; A. Gans, of 666 Bourse Building, Philadelphia, is treasurer; O. L. Stewart, of Huntingdon, is secretary, and John White is vice-president and will have the duties of general manager.

The Franklin Air Compressor Co. has been organized at Franklin, Pa., for the purpose of manufacturing air compressors for every application of compressed air power. The concern has applied for a charter of incorporation, with a capital stock of $300,000, and Gen. Charles Miller, of Franklin, will be president.

Fires and Accidents:—

The plant of the Kingsford Boiler Works, at Oswego, N. Y., was destroyed by fire. The loss is placed at $80,000.

New Construction:—

Ryan & Kelley, of Philadelphia, have been awarded the contract for the erection of the repair shops of the Philadelphia & Reading Railway Co., at Reading, Pa.; price, $400,000. The buildings are to be completed in one year.

The Buda Foundry & Mfg. Co., 917 Monadnock Block, Chicago, has purchased two acres of ground adjoining its present plant at Harvey, Ill., and is considering plans for an addition comprising a foundry.

The Portland Iron & Steel Co. has been organized at South Portland, Me., with a capital stock of $75,000, fully subscribed, to erect a plant on the site of the Portland mills, which were burned a year ago. It is expected that the new works will be in operation early in May and employment will be given to 50 men. Charles T. Means, of Manchester, N. H., is president of the company, and the treasurer is William S. McGowan, Jr., of Boston, until recently manager of the Hancock Inspirator Co.

The Detroit Steel & Spring Works Co., has asked for bids for the construction of a rolling mill building, 130x270 feet, to replace the structure burned some time ago. The construction will be steel frame, with corrugated iron roof and sides.

G. W. Wheland, of Sidney st., Chattanooga, Tenn., has placed the contract for the erection of a brick addition to the Wheland foundry.

Work is to be pushed, it is announced, on the new plant of the Columbus Steel Co., at Columbus, O. Contracts have also been awarded for the installation of a complete electric lighting plant.

Walsh & Weidner have commenced the erection of a new machine shop at Chattanooga, Tenn. The building will be a two-story structure with 1,500 square feet of space on the ground floor.

The Kentucky Furnace Co., capital $80,000, of Louisville, Ky., expects to commence the operation of the furnace at Paduch, Ky., about April 1. The daily capacity is 100 tons.

The new foundry at Racine, Wis., for the recently organized firm of Anderson, Olle & Tooman, is rapidly nearing completion. Both light and heavy castings will be made.

A new manufacturing site is sought by the Ornamental Iron & Wire Co., of Chattanooga, Tenn. A tract of land affording about four times the space of that at present occupied is sought.

Specifications are out for a plant for steel freight cars to be constructed at a cost of approximately $500,000 for the American Car & Foundry Co., of West Detroit, Mich., of which George Hargreaves, of 445 Terry ave., Detroit, is district manager. The building is to be two stories in height and 1,000 feet in length and the specifications include structural iron, sheet iron, galvanized iron, steam engine, etc.

The Pittsburg District:—

Both the Monongahela and Star tin plate mills, the Pittsburg plants of the American Tin Plate Co., resumed full operation this week. W. S. Collier, formerly vice-president of the Pittsburg district of the Amalgamated Association of Iron, Steel and Tin Plate Workers, has been made manager of the Monongahela plant.

G. B. Hartley, inspector of battleships at Cramp's shipyards, Philadelphia, and M. Browskey, a lieutenant in the Russian navy, stationed at present in Philadelphia, were in Pittsburg last week. They visited the Carnegie Steel Co.'s plant at Homestead and the plant of the National Tube Co., at McKeesport, for the purpose of witnessing final tests on material to be used in the two large battleships in the course of construction at Cramp's yard for the Russian government.

The Homestead Mfg. Co., Homestead, Pa., has sold its building and site to the Carnegie Steel Co., for the consideration of $10,000. The building will be razed to the ground and the site will be used for sidings for the Union railroad. The Homestead Mfg. Co., has secured quarters at No. 7 Wood st., Pittsburg, and has already commenced removing its machinery to these quarters.

The Pittsburg Sheet Mfg. Co. has prepared plans to double the capacity of its plant at Shousetown, Pa. Two new sheet mills will be installed, making it a four-mill plant. The building to be erected will be 200x50 feet. Two 15-ton cranes and additional power machinery will be purchased soon.

General Industrial Notes:—

The Bessemer Rolling Mill, Bessemer, near Birmingham, Ala., which was recently sold by Morris Adler and associates to the Tennessee Coal, Iron & Railroad Co., has resumed operations after an idleness of 10 years. The Tennessee company owns five blast furnaces at Bessemer, and recently acquired an extensive interest in the Bessemer Land & Improvement Co.

A 55-ton iron planer, manufactured by the Pond Machine Tool Co., of Plainfield, Mass., has just been installed at the plant of the Canton Chill Roll & Machine Co., at Canton, O.

The Princess Plow Co., Canton, O., included among recent shipments, consignments of plows to Liverpool and London, Eng.

The Canton Pump Co., Canton, O., has just made a ship-

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ment of 12 steam pumps to Hong Kong, China. The firm reports that its business for the first 10 weeks of the present year shows an increase of 100 per cent over 1899.

The Charlotte Steel & Iron Co.'s furnace at Charlotte, N. Y., will blow in March 15. after being thoroughly overhauled and its capacity increased to 75 tons per day.

The Frankford Steel & Forging Co., Frankford, Philadelphia, is very busy, and is running double time. The company manufactures a high grade product for which the demand has steadily broadened.

Jansenn Bros., of Columbia, Pa., last week purchased the Oxford, New Jersey, plant of the Empire Iron & Steel Co., for $600,000. The plant embraced one furnace and a rolling mill. It will at once be put into operation by its purchasers.

The Franklin Forging & Steel Co., Allegheny, Pa., has purchased 30 acres of land at Chester, Pa., upon which a plant will be erected. It is the present intention to have work commence on the erection of the buildings by April 1. About $200,000 will be spent in the erection of buildings. The new plant will be located close to the proposed Gruson Iron Works at Chester.

The Brown Hoisting & Conveying Machine Co., of Cleveland, is atwork on a very complete coal handling plant for the Egyptian State Railway. The plant will cost upwards of $300,000 and will constitute one of the largest machinery shipments ever made from this country. It will be installed at Alexandria. There are six machines capable of handling 3,000 tons of coal in a day of 10 hours. The Brown company has also just made a large shipment to Austria and is filling important orders for firms in China, Brazil and Sweden.

Samuel Mather, H. G. Dalton, and other members of the firm of Pickands, Mather & Co., of Cleveland, have presented to the Ontario provincial legislature a bill providing for the incorporation of the Mineral Range Railroad. The line is designed to open up the newly discovered Michipicoten mining district and provide an outlet for the ore from that section to a shipping port on Lake Superior.

Since the middle of December, nearly 45,000,000 bushels, or about 1,500,000 tons of coal have passed through Pittsburg by boat, for shipment to Southern markets. The open winter has materially aided the shipment of the product to Southern ports by water instead of rail.

TINNING PROCESS FOR CASTINGS.

A correspondent of the *American Machinist*, "F. C. F.," gives the following description of a process for tinning castings, iron ware, etc., that may be regarded as up-to-date:

First clean the drawn or stamped iron parts carefully in a pickle made by taking three gallons of vitriol to which add two gallons of water. Heat this mixture by coiled steam pipe, very hot, in a tub or iron kettle or wooden tank, zinc lined. Pickle articles until clean. Experience alone will teach the time required, but say 10 to 15 minutes, according to the age of the solution, will be about right. The size of the vat is approximately 2½ feet wide, 4 feet long and about 2½ feet deep, 2-inch wood and zinc-lined. It has an inside cage, or box, hinged on a bail, which connects it with a chain and pulley, which raises and lowers this cage by means of a windlass fastened to a frame on the outside of the vat. Into this cage the articles for pickling are put, for quick handling. When the cage is full it is lowered by means of the windlass into the vat which contains the pickle and allowed to remain there until cleaned.

After removing from the pickle vat the articles are placed in a second vat, which contains clean, cold, running water, which kills the pickle. A second rinsing is now given the aritcles in hot water, which cleans and dries them.

The acid bath may be made by cutting a 42-gallon barrel

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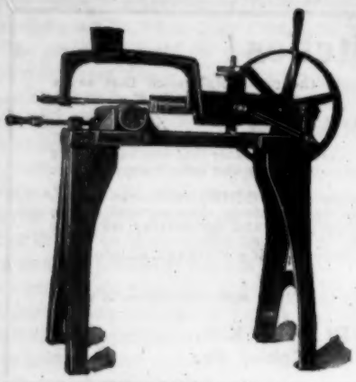

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in two. Partly fill with a solution of muriatic acid which is weakened by the use of spelter; one gallon of acid allowed to consume one pound of spelter makes the proper proportion usually used. The articles are now placed in the bath and remain there from three to five minutes, according to the time the operator takes to tin them, which is the next process.

The articles are now ready to take their first coat of tin upon the iron surface. This first coating of tin does not leave the articles in a clear, bright state, but rather in a dull-looking condition. It is, however, necessary to get a good surface or foundation for the final retinning, which will be explained in its proper turn. In this first tinning many pieces are sometimes tinned at once for the sake of rapid production. The tinning furnace is of cast iron, as regularly made for such work. Door-frames, grates and cast iron trimming are set in brick work, with a suitable melting pot over the furnace, which is heated by burning common hard nut coal. The size of the melting kettles used depends upon the size of the work done. The one used in this case was about 3 feet long, 2 feet wide and 18 to 20 inches deep, well filled with melted block tin of good quality. This is kept very hot and tins the article quickly. Less than one minute will usually tin an article of quite large size. A paper hood is placed over this melting pot to carry off all the impure gases which arise, keeping the air clear and pure in the room. After taking the articles from this pot they are spread about on a long wooden table, or bench, and allowed to drain and cool, and the tinning to set. This ends the process of first tinning. They are now ready for their final orsecond retinning process.

Retinning.

Articles stamped from tin plate lose their lustre in the process of manufacturing, which makes it necsesary to retin them, and this is done as below stated: There must be a furnace for tallow. This is a common furnace, over which is placed a cast iron kettle 24x24 inches and 18 inches deep, which is kept well filled with melted tallow of the commonest kind (condemned or rancid oloemargerine is sometimes used, which answers the purpose very well). Palm oil is sometimes used, but owing to its expense a cheaper substitute in the tallow is now almost exclusively used. This melted tallow is kept very hot, its object being to open the pores of the aritcles to be tinned so that they will be filled with new tin easily and quickly. The articles are allowed to remain in this vat from five to eight minutes, and are piled into it in quantities, so that they will become thoroughly heated. When taken from this vat of tallow their appearance is very black and dirty, but this soon disappears in the next operation.

The retinning vat is of the same size and form as the tallow furnace vat, only that it is filled with pure, best quality block tin melted and kept as hot as possible. The articles are submerged in this tinning vat, where they are turnd over several times by the operator, to allow them to get an even coating of tin. They are then dipped into a second tallow vat, which is in construction and size the same as the first tinning vat. This operation seems to set the tin coating and give it a clear, bright appearance. Being now removed from the second tallow vat, the articles are placed against a draining rack, which allows the tallow to drain into a proper receptacle and remain in a melted state, and at the same time allowing the coating to set on the article so that it can be handled for scouring off the remaining tallow, which is done with sawdust.

While the articles are still warm they are taken from this draining rack and placed in a box on legs, which contains fine

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cedar sawdust. With this sawdust they are cleaned from the remaining tallow, and the lustre begins to appear, the cleaning being done by boys, who rub the articles with a soft felt glove, which does the work quickly. This sawdust is very fine and soft, so that the gloss left on the articles shall not be scratched. This sawdust box is about 4 feet long, 2½ feet wide and about 18 inches deep, and is nearly half filled with the sawdust.

The final high-polish gloss is now secured, which is the last handling. This is done by taking the articles from the sawdust box and placing them in the flour box, which is about half full of fine common flour and the finest of the cedar sawdust, mixed in about one pound of sawdust to 10 pounds of flour. The articles are carefully rubbed in this mixture with flannel or other soft cloth. This finishes them so that they are ready for inspection and packing. Sometimes it happens that the articles are not perfect. These are thrown out and are again retinned, usually coming out all right the second time. This retinning leaves a beautiful, bright, clear lustre.

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vat, two cleaning one block tin vat, second tallow vat, sawdust boxes, with bench along one side of the room for storing goods. One operator for each handling is required. Common cast iron furnaces and kettles set in brick work. Anthracite nut coal is generally used for heating; there is no objection to gas or other methods, except their expense. Vitriol, 3 parts, and water, 2 parts, for pickle; use hot. Acid bath—muriatic acid, 1 gallon, and spelter, 1 pound, dissolved. For first tinning good, fair block tin is used. For retinning very best block tin is used. Tallow vats; commonest kind of tallow; sawdust. Fine cedar sawdust for cleaning. For lustre, fine cedar sawdust, 1 pound, and common flour, 10 pounds. The operations are very rapid by experienced hands.

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4:25	1:05	7:05	Lorain	9:10	11:30	6:37
4:40	1:20	7:20	Elyria	8:54	11:16	6:23
4:56	1:38	7:41	Grafton	8:35	10:59	6:05
5:15	1:57	8:00	Lester	8:15	10:41	5:47
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4:40	1:00	7:10	Cleveland	9:10	11:40	6:40
4:54	1:16	7:24	Brooklyn	8:54	11:24	6:26
5:45	2:02	8:14	Lester	8:10	10:40	5:40
5:56	2:11	8:23	Medina	7:55	10:30	5:26
6:19	2:30	8:43	Seville	7:33	10:10	5:05
6:26	2:36	8:49	Sterling	7:27	10:04	4:59
6:48	2:58	9:11	Warwick	7:05	9:42	4:35
6:56	3:05	9:18	Canal Fulton	6:58	9:35	4:28
7:16	3:23	9:39	Massillon	6:40	9:18	4:11
7:31	3:40	9:58	Justus	6:24	9:03	3:55
8:01	4:11	10:26	Canal Dover	5:55	8:34	3:26
8:08	4:18	10:33	New Philade	5:48	8:27	3:18
8:25	4:35	10:50	Uhrichsville	5:30	8:10	3:00
	4:50	11:15	D. " A.		8:10	3:00
	6:50	1:15	Bridgeport		6:10	1:00
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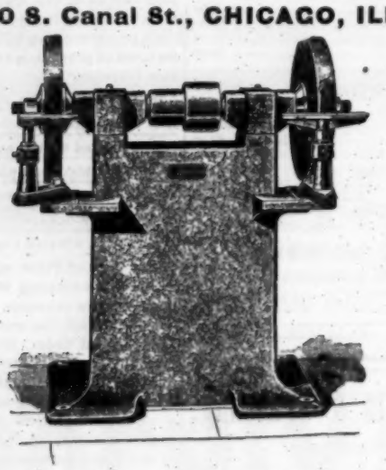

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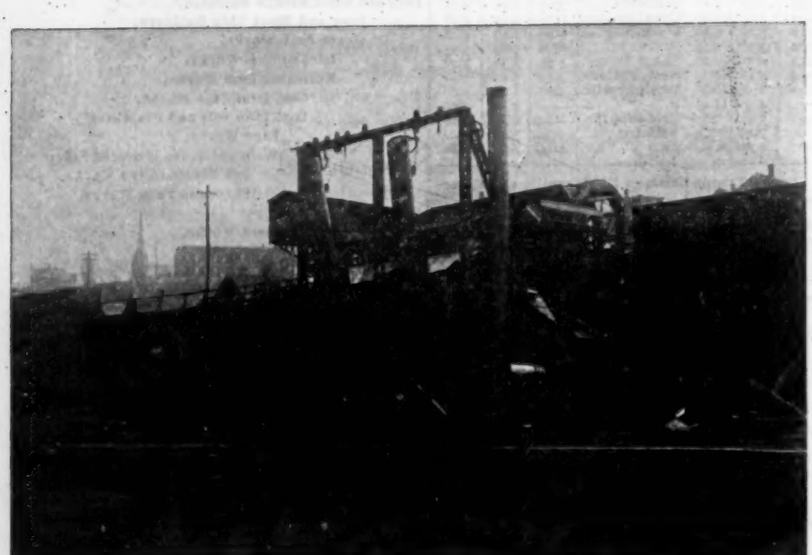

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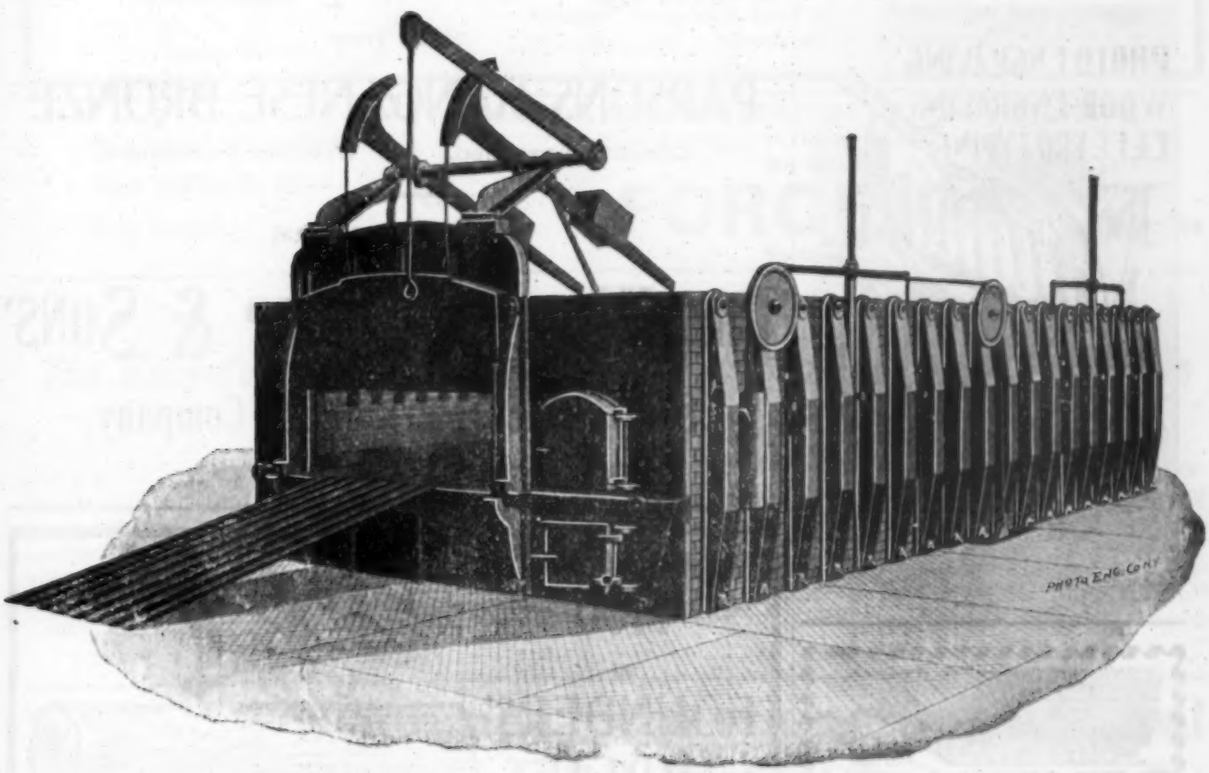

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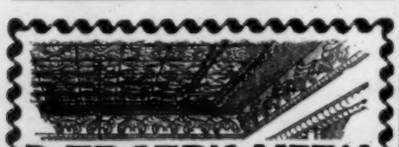

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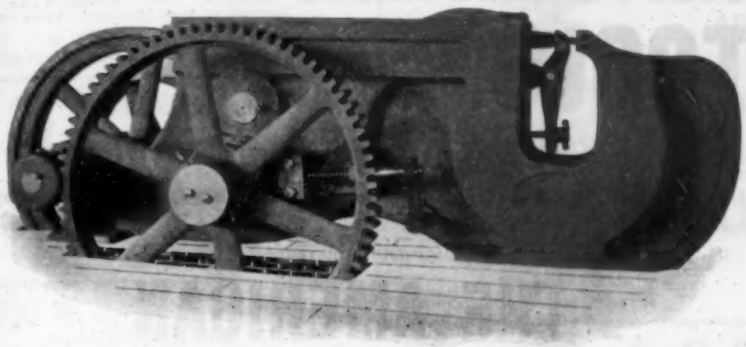

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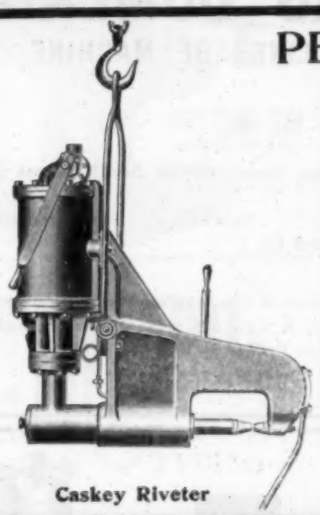

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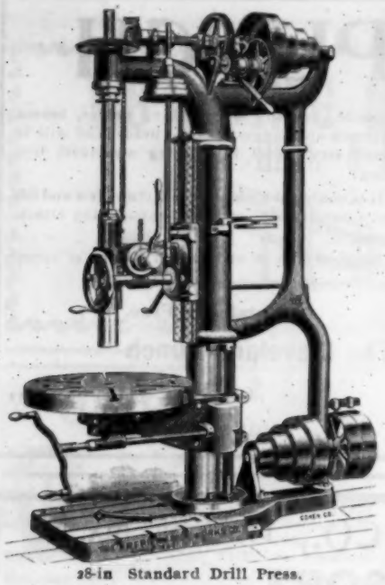

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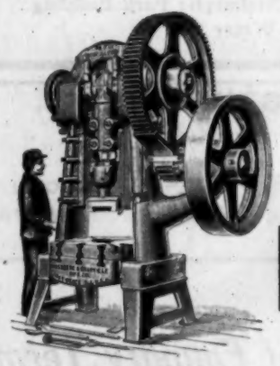

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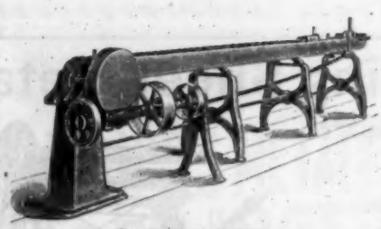

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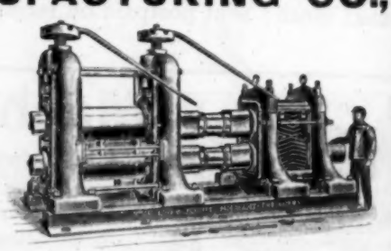

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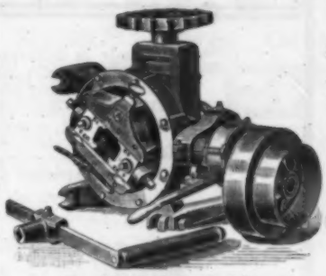
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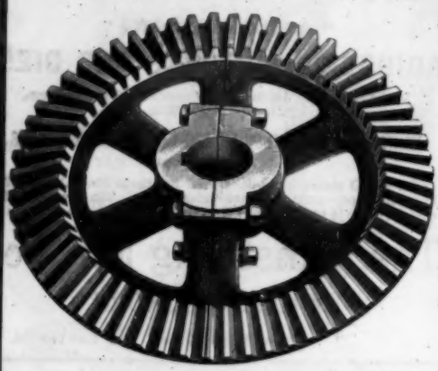

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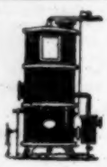

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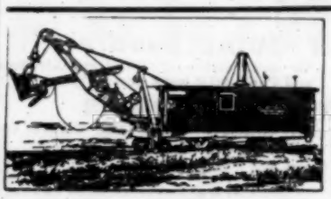

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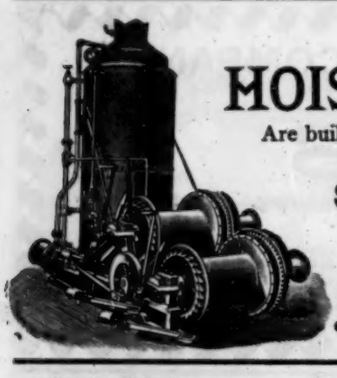

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AN OPEN LETTER.

TO THE EDITOR OF THE IRON TRADE REVIEW:

Doubtless many of your readers are users of nuts, and if so have experienced the common difficulty of keeping them tight on the bolts.

No matter how tight they are when first put on, they soon work loose and rattle off where there is any jar or vibration. In fact this is the acknowledged and almost universal complaint, as is eloquently proclaimed by the various nut-locks, jam-nuts, spring-washers, keys, etc., on the market, gotten up in the vain attempt to fasten a nut securely and permanently. Experience has proven most of these wholly inefficient after a short time, and that all of them, without exception add greatly to the cost of the nut.

In view of the above, we believe that your readers will be interested to learn of a thoroughly practical and successful self-locking nut, that locks itself on the bolt wherever placed and that effectually and completely overcomes the difficulties presented above.

This is our Elastic Self-locking Steel Nut, and we have thought best to take this space in your valuable paper to tell your readers something about this wonderful nut that has proven so simple, efficient and inexpensive, that it has within the last few years fairly supplanted the use of the common nut where nuts are liable to work loose. On that account it is now used regularly by many of the largest Railroads, Bridge Builders, Machinery Manufacturers, Engineers, Car Builders, etc., of the country. The Elastic Nut owes its self-locking feature to its peculiar manufacture, as it is made in an entirely different manner from the ordinary nut. It is made of a flat bar or section of steel bent around into a ring, and then this ring is pressed into the shape of a nut having a lapped opening on the side. It is then tapped or threaded slightly smaller than the standard bolt, so that when wrenched on, the nut is distended a trifle and grips the bolt which holds it from ever working loose like the ordinary nut.

Being made in this manner and of steel, the Elastic Nut is always stronger than the bolt, and if put down to breaking strain will invariably break the bolt without injuring the nut in the least. In fact, as one customer puts it, "It makes a fastening on the thread end of the bolt as strong, permanent and secure as is the bolt head on the other," and at a much less cost than any other method. Also for use where a self-locking nut is not required, by simply tapping them full standard instead of scant, they are then practically the common nut and many large concerns whose work does not require a self-locking nut, are using them in this way.

These nuts though much superior in every way to the ordinary iron nut, can be furnished for considerably less, as the special method of manufacture saves entirely the ordinary scrap waste of about forty per cent. We are therefore able to furnish users of nuts with the best nut on the market (either self-locking or not as desired) and at a less price than the ordinary nut. We make these nuts in sizes from ⅝ in. up to 1¼ in. both inclusive and can furnish them either rough for ordinary railroad and car work or semi-finished and finished for finer machine work.

As previously stated, many of the largest concerns are using these nuts, and from our list of orders we mention, New York Central & Hudson River Ry., Haskell & Barker Car Co., Pennsylvania Steel Co., The Edward P. Allis Co., Fraser & Chalmers, The Atlantic Works, Link Belt Engineering Co., National Machinery Co., etc.

We issue a little booklet giving additional information that we will be glad to send to any of your readers who will write for it, and shall also be glad to send samples and prices on request. Hoping that we may hear from them liberally, we are,

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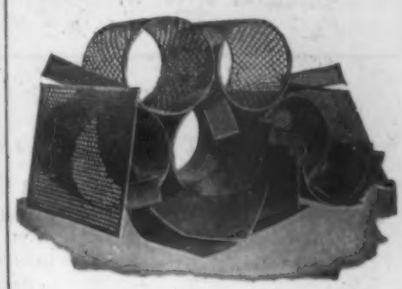

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Ore Buckets,
Automatic Coal Buckets,
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The A B C of Iron.

Is issued in cloth binding, and gives much valuable matter on how to reduce cost of mixtures, and on grading and numbering of pig iron. CHAPTER HEADINGS:—Iron—What is it? Pig Iron. constituents of Iron. Numbering of Pig Iron. Grading of Iron. How to Reduce Cost of Mixture. Steel. Physical Properties of Metals Defined. Statistics. Early History and Manufacture of Iron. Former price $2.00, NOW $1.00. Order of *The Iron Trade Review Co.*, 27 Vincent St., Cleveland, O.

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The "Every-Thirty-Days" List.

The March issue of the "RED" LIST is now out. If you are a railroad official, you should have received your copy; if you have not, write us for it at once.

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Compare the "THIRTY-DAY" List with any other similar publication as regards accuracy and completeness.

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Extend your business and create a demand for your devices in new fields.

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unless you wish to save money. The Emery Wheel question easily solved for you.

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STAR EMERY and CORUNUM WHEELS

have all these qualities and many others. A trial order will convince you.

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Fire Brick, Cupola Blocks, Molding Sand and General Foundry Supplies

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Tuyeres and Brick Converter Bottoms for Bessemer Steel Works; also Ladle Nozzles, Stopper Rod Sleeves, Runner Brick for Bottom Casts. Blast Furnace Linings, Ground Fire Clay, and all kinds of Fire Brick.

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Write for catalogue and particulars.

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For measuring temperatures between 0 and 2900° F.

Recommended by the Highest Authorities.

Successfully used in establishments for the manufacture of

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Iron and Steel, Malleable Iron.

Also by Boiler Inspectors, Schools and Colleges, for hardening and annealing steel in roll foundries, etc.

VULCAN MFG. CO., Ltd.,
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PETER GERLACH & CO.,
MAKERS OF
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A book for foundrymen. It is issued in cloth binding, and gives much valuable matter on how to reduce cost of mixtures, and on grading and numbering of pig iron. CHAPTER HEADINGS:—Iron—What is it? Pig Iron. Constituents of Iron. Numbering of Pig Iron. Grading of Iron. How to reduce cost of mixture. Steel, Physical Properties of Metals Defined. Statistics. Early History and Manufacture of Iron.

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All Sizes
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MACHINE AND ARCHITECTURAL PATTERNS OF ALL DESCRIPTIONS.
Gear Work a Specialty.
Patterns for Castings from ¼ pound to 50 tons. Send on your Drawings and get prices.

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ESTABLISHED 1883

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One who watches carefully the pages of general advertising mediums is struck by two things: the persistency with which those advertisers who are recognized as successful maintain their advertising week after week, month after month, and year after year; they never seem to abate their effort, and apparently the volume of their business increases steadily. The other thing noticeable is the large number or advertisers who thrust their announcements above the surface for a little while and then sink into oblivion. They either had not merit as a basis for their claims or they did not possess the skill to steer their enterprise successfully, or else they lacked the nerve to put forth proper effort.—[Advertising Experience.

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"The Alpha and Omega of the pressed steel car," writes the General Superintendent of a great American railroad, "is that it admits of a maximum of revenue-bearing tonnage being hauled with a minimum of dead weight." . . . THAT IS WHAT IT IS BUILT FOR.

PRESSED STEEL CAR COMPANY.

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MAKERS OF

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Furnished both Dry and Ground in Oil.

Used by nearly all the Railroads.

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Best Bronze, Babbitt Metals, Brass and Aluminum CASTINGS On Short Notice.

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A small quantity added to any Oil or Grease largely increases its lubricating value and makes the finest Cooling Mixture.

Pamphlet and Sample Sent Free.

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We Claim The Following Merits for Jenkins Bros.' Valves

1. Manufactured of the best Steam Metal.
2. No regrinding, therefore not constantly wearing out the Seat of the Valves.
3. Contain JENKINS DISC, which is suitable for all Pressures of Steam, Oil and Acids.
4. The Easiest Repaired, and all parts Interchangeable.
5. Every Valve Tested before leaving the factory.
6. ALL GENUINE stamped with Trade Mark,

(2)

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WM. B. FRANKLIN, Vice-President.

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C. A. BURWELL, Chief Inspector, 32 and 33 Clark Bldg., 208 Superior St., Cleveland, O.

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"Metallurgy of Cast Iron,"

Price $3.

NATIONAL TUBE COMPANY,

Manufacturers of

BLACK and GALVANIZED
Wrought Merchant Pipe, all kinds: sizes 1-8-inch to 30-inch, fitted in any manner desired.

BOILER TUBES,
Mild Steel and Charcoal Iron, for Stationary, Locomotive and Marine Work.

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SEAMLESS
Tubes, Shrapnel, Projectiles and Miscellaneous Forgings.

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Office of Mercantile and Manufacturing Departments, Conestoga Bldg., PITTSBURG, PA.

LOCAL SALES OFFICES:

Havemeyer Building, NEW YORK CITY. 70 Federal St., BOSTON.
267 S. 4th St., PHILADELPHIA.
Fidelity Building, PITTSBURG. Western Union Building, CHICAGO.

Foreign Office: Dock House, Billiter Street, LONDON. Telegraphic Address: TUBULIFORM, LONDON.

National Steel Company

CHICAGO, ILL.

Manufacturers of

Bessemer and Open-Hearth Billets

Sheet and Tin Plate Bars.

THE CASTING AND CONVEYING OF METAL

Exhibit showing furnaces where the UEHLING METHOD has been adopted.

Location.	Stacks.	Daily Capacity. Tons.	Style Machine.
National Tube Works Company, McKeesport, Pa.	2	600	Double.
Carnegie Steel Company, Ltd., Duquesne, Pa.	4	2,400	Double.
Carnegie Steel Company, Ltd., Edgar Thompson	9	3,500	Six.
Carnegie Steel Company, Ltd., Rankin (Carrie)	2	700	Double.
Carnegie Steel Company, Ltd., Pittsburg (Lucy)	2	800	Double.
Struthers Furnace Company, Struthers, O.	1	300	Single.
Laughlin & Co., Ltd., Pittsburg, Pa. (Eliza)	5	2,000	Double (2).
Oliver & Snyder Steel Company, Pittsburg, Pa. (Edith)	1	400	Double.
Oliver & Snyder Steel Company, New Castle, Pa. (Rosena)	1	500	Double.
Shenango Valley Steel Company, New Castle, Pa.	2	800	Double.
Bellaire Steel Company, Bellaire, O.	2	700	Double.
Lebanon Furnaces, Lebanon, O.	2	500	Double.
Tennessee Coal, Iron & Railroad Company, Ensley, Ala.	4	800	Double.
Riverside Iron Works, Wheeling, W. Va.	2	700	Double.
American Steel & Wire Co.	7	3,000	Double (3).
Totals	46	17,700	

For particulars write

G. H. GINTHER, Special Agent, Carnegie Bldg., Pittsburg, Pa.

BY THE

Uehling Method

is covered by U. S. patents Nos. 548,146, 629,480 and 632,031, which are fundamental, and others are pending.

The use of the Uehling Method at the furnaces mentioned has shown reduced labor cost, while SANDLESS IRON has proved a great advantage to the consumer.

AMERICAN STEEL AND WIRE CO.

CHICAGO. NEW YORK. SAN FRANCISCO.

FOR RAILROAD USE WE MAKE

Woven Wire Railroad Fences.

The "AMERICAN," "ELLWOOD" and "McMULLEN" RAILROAD FENCES.

High Carbon Steel Wires woven together so as to provide amply for expansion and contraction.

Thoroughly galvanized so as to secure length of life. ABSOLUTELY the BEST and CHEAPEST RAILROAD RIGHT-OF-WAY FENCES. Write for Catalogue.

We take contracts for the erection of Railway Right-of-way Fences anywhere in the world, having our own experienced employes, our own trains and equipment, for doing this class of work in the best and cheapest manner.

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Galvanized Iron and steel Telegraph Wires made in accordance with W. U. and Postal Telegraph Companies' most rigid specifications.

Copper Wires and Cables of all kinds.

Insulated Wires and Cables for every purpose.

Lead encased Wires and Cables of all sizes for underground work.

Copper Rail Bonds—acknowledged the best wherever used.

Copper Trolley Wires.

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Iron and Steel Wire Rope for all purposes.
Galvanized Guy Ropes.
Galvanized Steel Signal Strand.
Locomotive Switching Ropes, complete.
Plow Steel and Crucible Cast Steel Hoisting Ropes.
Ballast Unloader Cables fitted complete.
Transmission Rope.
Cableways for Mines, Quarries, or Excavating work of all kinds.
Suspension Bridge Cables.

SPRINGS.

Flat and Coiled Wire Springs of every size and for every purpose made in accordance with specifications in every detail.

CAR TRUCK SPRINGS. TROLLEY SPRINGS.
CAR SEAT SPRINGS. BUNK SPRINGS.
BRAKE SPRINGS.

Any desired temper. Any desired grade of Steel.

SHAFTING.

Cold-drawn Steel Shafting, any size, highest quality, lathe-cut or saw-cut ends, guaranteed perfect. Rounds, Squares, Hexagons, Flats or odd shapes.

Wire Nails. Spikes. Pole Steps. Tacks. Rivets. Staples. Lightest and Best Barb Wires.

NOTE OUR "DIFFERENTIALS."

We make our own steel, and accurately fulfill all specifications as to exact quality. We are able to guarantee quality by our own personal and intimate knowledge of our Steel. We are in position to see that you get just what you want for your "different" or special needs, depending for exact knowledge on none but our own works.

Jones & Laughlins, Ltd.,

AMERICAN IRON AND STEEL WORKS,

PITTSBURGH.

Branch House, Chicago, Ill. **Branch Office, 220 Broadway, New York.**

We invite attention to the full line of Bars, which we manufacture.

FLATS, 1-2 INCH TO 14 INCH INCLUSIVE.
SQUARES, 3-16 INCH TO 4 INCH INCLUSIVE.
ROUNDS, 3-16 INCH TO 7 1-4 INCH INCLUSIVE.
(Including Rivet Sizes.)

Bessemer and Open Hearth Qualities. Orders Solicited. Prompt Service.

CHAMPION IRON & STEEL COMPANY

MANUFACTURERS OF

Open Hearth Ingots, Billets and Bars,
Merchant Bar Iron and Bar Steel.

Also Buyers of

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Muskegon, Mich.

Solicit correspondence.

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General Offices: PITTSBURG.

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Steel Hoops
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Cotton Ties
Steel Bars
Special Shapes
Angles
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Small Tee Rails
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Open Hearth Steel

District Sales Offices:

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run the lines of the Illinois Central Railroad and the Yazoo & Mississippi Valley Railroad, reaching into the eleven States of

South Dakota	Kentucky
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Presenting an unequaled territory for diversified industries, and possessing

Fine Sites for New Mills

Best of Freight Facilities,—Coal Fields,

Close Proximity to Distributing Centers

Intelligent Help of All Kinds,

Many Kinds of Raw Material.

To sound industries, substantial inducements will be given by many of the places concisely described in the pamphlet "100 Cities and Towns Wanting Industries." Write for a copy. Nearly all kinds of industries are wanted. Very liberal inducements are offered TEXTILE INDUSTRIES in the South by a number of good places. GEORGE C. POWER, Industrial Commissioner I. C. R. R Co. Chicago

A large and growing circulation among machine shop and foundry firms has

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REPUBLIC IRON & STEEL COMPANY,

General Offices: Stock Exchange Building, CHICAGO, ILLINOIS.

BAR IRON:	BAR STEEL:	PLATES
Common, Refined, and B.B. Iron,	Bessemer and Open Hearth,	and Angles, Turnbuckles, "T" Rails, 8 to 20 lbs., Cold Rolled Steel, Cut Nails,
Flats, Rounds, Squares, Ovals, etc.	Flats, Rounds, Squares, Ovals,	SHEETS (Black and Galvanized), Harrow Teeth, Bolts and Nuts,
Chains and Rivet Iron,	Angles, Channels, Special Shapes,	R. R. SPIKES, Steel Fence Posts, Steel Whiffletrees, CrossArmBraces, PoleSteps.
Maud S. Horse Shoe Bar,	Round Edge Steel Tire,	
Skelp Iron, etc.	Agricultural Shapes, etc.	

FOUNDRY, BESSEMER AND MILL PIG IRON.

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THE

LORAIN STEEL COMPANY,

Lorain, Ohio.

Rails, Blooms, Billets and Slabs.

American Tin Plate Company

MANUFACTURERS OF

Coke Tin Plates,
Charcoal Tin Plates,
High Grade Terne Plates,
Black Plates.

GENERAL OFFICES:

Battery Park Building,
NEW YORK CITY, N. Y.

Wants and Sales

For our subscribers and advertisers only, we will insert under this head advertisements of help wanted and situations wanted free of charge. The advertisements to be inserted in three consecutive issues and to consist of not more than six lines each. All other advertisements will be charged at regular card rates.

Wanted—Machinists, lathe, slotter and horizontal boring hands; best wages paid. Apply at Jeffrey Mfg. Co., Columbus, O.

Wanted—steel molders; must be experienced; highest wages paid; no labor trouble. Pittsburg Steel Foundry, Glassport, Pa.

A gentleman of large experience as buyer for manufacturing company, is now open for similar engagement elsewhere. Familiar with all kinds of office work. Best of references furnished. Address "C" care IRON TRADE REVIEW.

Wanted—Machinists, both floor and tool hands. Apply immediately to the Bucyrus Co., South Milwaukee, Wis.

Wanted—First class all around blacksmith on machine and tool forging. The Danielson Machine & Tool Co., 83 Lake St., Cleveland, O.

Wanted—Metal pattern makers and machinists. Fanner Mfg. Co., Brookside Park, Pearl St., Cleveland, O.

Skein molders wanted; can give steady employment to 2 or 3 good, experienced wagon skein molders. Do not apply unless you are experienced in this branch of work and want steady employment. Work by the piece at as high prices as any factory in the country. A. C. Williams, Ravenna, O.

Wanted—Ten good machinery molders; wages $3 per day to competent men Standard Foundry & Mfg. Co., cor Herald st and Grand av. Cleveland O.

Wanted—Metal pattern maker. Apply corner Elm and Winslow, Forest City Foundry & Mfg. Co., Cleveland, Ohio.

Machinists wanted; good men only. Columbus Machine Co., Columbus, Ohio.

Wanted—First class patternmakers and molders, those accustomed to cast iron pipe work preferred. The Massillon Iron and Steel Co., Massillon, Ohio.

Wanted—Foreman for gray iron foundry in Massachusetts. State experience and salary expected. 106, care THE IRON TRADE REVIEW.

Wanted—Man familiar with laying out and rivetting structural and tank work in the shop. Capable of handling a few men. Good prospects. Address 105 care THE IRON TRADE REVIEW.

Wanted—One second-hand steam hammer, 1000 lbs. to 2000 lbs. capacity, of either Morgan, Sellers or Bement make State condition and lowest price. Address Steam Hammer, care THE IRON TRADE REVIEW, Cleveland, Ohio.

Wanted—Experienced press man to take charge of our stamping department; steady job and good wages for the right man E. Konigslow & Bros., 186 Champlain st., Cleveland, Ohio.

Wanted—Six men experienced in electric wiring Apply to American Shipbuilding Co., Lorain, O.,

Wanted—Three or four good molders for machinery castings; standard wages and steady job offered to good, sober, industrious mechanics; state experience, age and give references. Apply or address Kenney & Co., Scottdale, Pa.

FOR SALE.

Ten 54 in. by 16 ft. second-hand tubular boilers, including fronts, castings and fittings; boilers are in splendid condition. McNeil Boiler Works Akron Ohio.

RAWHIDE GEARS.

Nazel & Bassett,

Engineers and Machinists,

1046 Ridge Ave., PHILADELPHIA, PA.

FOR RENT OR SALE.

The Axle Works property No. 694 Broadway at Junction of Broadway, Erie and Cleveland Terminal & Valley railway, Cleveland, O., including engine, boiler and shafting; or will erect on these premises buildings to suit tenant, if leased for a term of years. Address

CLEVELAND AXLE MFG. CO.,
Canton, O.

ESTABLISHED 1854.

WE OWN—FOR SALE,

For Immediate Delivery.

1 Mundy 7 x 12 single cylinder, single drum Hoisting engine, with boiler.
1 8 x 10 Atlas Automatic Engine.
2 Dean Duplex Pumps, 10 x 6 x 10.
1 No. 5 Nye Pump.
1 No. 8 Centrifugal Pump.
1 No. 6 Centrifugal Pump.
1 Gardner Duplex Pump, 6 x 4 x 6.
1 Smith-Vaile Duplex Pump, 3 x 3 x 4.
1 Worthington Duplex Pump, 4½ x 2¾ x 4.
1 American Hoist, Double Gear Crab.

Our specialties are:

CARS,
LOCOMOTIVES,
STEAM SHOVELS.

Write us.

TORBERT & PECKHAM,

16th Floor. - - Monadnock, Chicago.

CASTINGS.

Having just added to our plant an excellently equipped foundry and having larger capacity than we ourselves will use, we solicit work in this department. We have facilities for producing most excellent

Gray Iron Castings

promptly and in any quantity.
We will also contract to make stoves or other goods from jobbers' patterns.
Address

Detroit Galvanizing & Sheet Metal Works,
Detroit, Mich.

FOR IMMEDIATE DELIVERY

ANGLES, BEAMS,
CHANNELS, PLATES,
TEES, ZEES, BARS.

Cut to specified sizes.

5,000 tons in stock. Moderate prices. Send for stock sheet and quotations.

Structural Department
ILLINOIS STEEL CO.,
Designers, Manufacturers and Erectors of Structural Iron Work. Dealers in Structural Materials.
50 Wabansia Ave. CHICAGO.

New and Relaying Rails

FOR SALE.

16 and 20 lb. Steel Relaying Rails with splices, Louisiana.

25 lb. Steel Relaying Rails with splices, Michigan.

40 lb. Steel Relaying Rails with splices, Ohio.

50 and 60 lb. Steel Relaying Rails with splices, Pennsylvania.

All first class condition, subject to any inspection. Immediate shipment.

HYDE BROS. & CO.,
Lewis Block, PITTSBURG.

SECOND HAND MACHINERY
FOR SALE.

1 Engine 12 by 24, made by ZEHM BROS., Kutztown, Pa. Guaranteed in first class condition.
1 No. 7 Sturtevant Blowers.
1 8 in Exhaust Blower.
2 6 in. Exhaust Blower. (New)
1 Nut Tapping Machine.
1 Automatic Bolt Cutter.
1 Tire Bender.
1 Tire Shrinker.
1 Screw Slotter Machine.
1 Blacksmith Forge for hand and power, built by Champion people.
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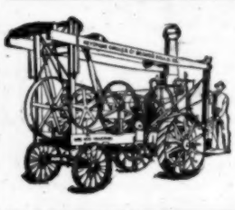

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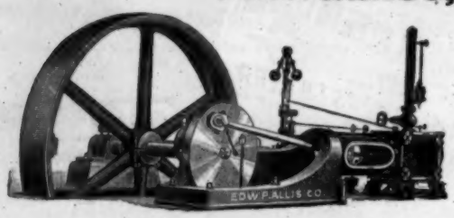

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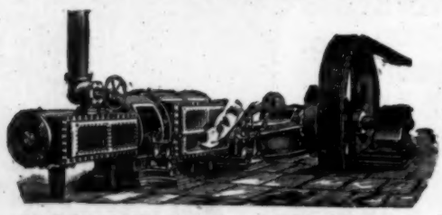

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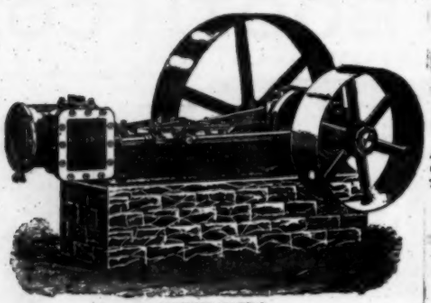

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Cleveland City Forge & Iron Co., Cleveland, O.
Bethlehem Steel Co., South Bethlehem, Pa.
Braeburn Steel Co., Braeburn, Pa.
Wyman & Gordon, Worchester, Mass.
Danielson Machine & Tool Co., Cleveland, O.
Samuel Trethewey & Co., Pittsburg, Pa.
Jas. H. Baker Mfg. Co., Pittsburg, Pa.
Joseph Dyson & Sons, Cleveland O.
Frankford Steel & Forging Co., Philadelphia, Pa.
J. & G. Obenberger, Milwaukee, Wis.

FOUNDRIES—
Wm. Tod & Co., Youngstown, O.
Seaman, Sleeth Co., Pittsburg, Pa.
Hooven, Owens & Rentschler Co., Hamilton, O.
W. A. Jones Foundry Co., Chicago.
Jeffrey Mfg. Co., Columbus, O.
Brass Founders' Supply Co., Newark, N. J.
The Aultman Co. Canton, O.
Schuylkill Iron & Steel Co., Philadelphia, Pa.
Riverside Foundry Co., Cleveland, O.
I. & E. Greenwald Co., Cincinnati, O.
Wheeling Mold & Foundry Co., Wheeling, W.Va
Excelsior Iron Works Co., Cleveland, O.

Macbeth & Co., Cleveland, O.
Vulcan Foundry & Machine Co., New Castle, Pa

FOUNDRY EQUIPMENT.
Tabor Mfg. Co., Elizabeth, N. J.
Brass Founders Supply Co., Newark, N. J.
Vulcan Mfg. Co., Pittsburg, Pa.
Northern Engineering Works, Detroit, Mich.
Cleveland Crane & Car Co., Cleveland, O.
Whiting Foundry Equipment Co., Harvey, Ill.
Thos. Furlow & Son, Philadelphia, Pa.
Maywood Foundry & Machine Co., Chicago, Ill.

FOUNDRY FACINGS—
Cleveland Facing Mill Co., Cleveland, O.

FOUNDRY SUPPLIES—
Northern Engineering Works, Detroit, Mich.
Chas. Taylor's Sons Co., Cincinnati, O.
Clearfield Fire Brick Co., Clearfield, Pa.
Cleveland Crane & Car Co , Cleveland, O.
Thos. Furlow & Son, Philadelphia, Pa.
The Ohio Sand Co., Conneaut, O.
Union Mining Co., Mt. Savage, Md
Dover Fire-Brick Co., Cleveland, O.
A. F. Smith & Co., New Brighton
Tabor Mfg. Co., Elizabeth, N. J.
F. B. Stevens, Detroit, Mich.
Whiting Foundry Equipment Co Harvey, Ill.
Cleveland Facing Mill Co., Cleveland, O.
Garden City Sand Co., Chicago, Ill.
Chicago Fire Clay Product Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.
Vulcan Mfg. Co., Pittsburg, Pa.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth, O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
J. V. Rose, Sharon, Pa.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Detroit, Mich.
Newport Sand Bank Co., Newport, Ky.
Maywood Foundry & Machine Co., Chicago, Ill.
A. J. Haws & Son, Johnstown, Pa.

FRICTION METAL—
James B. Clow & Sons, Chicago, Ill.
Theo. Hiertz & Son, St. Louis, Mo.
C. H. Besly & Co., Chicago, Ill.
Swarts Metal Refining Co., Chicago, Ill.
Magnolia Metal Co., New York City.
Perfect Lubricating Metal Co., Cincinnati, O.
J. J. Ryan & Co., Chicago. Ill.

FURNACE LININGS—
Union Mining Co., Mt. Savage, Md.

FURNACE, MELTING—
Whiting Foundry Equipment Co., Harvey, Ill.

FUEL OIL BURNERS—
Rockwell Engineering Co., New York City.

GALVANIZED IRON—
Apollo Iron & Steel Co., Pittsburg, Pa.

GALVANIZERS—
Ætna-Standard Iron & Steel Co., Bridgeport, O
Apollo Iron & Steel Co., Pittsburg, Pa.

GALVANIZING POTS—
The Wm. B. Pollock Co., Youngstown, O.

GAS ENGINES—
Northern Engineering Works, Detroit, Mich.

GAUGE COCKS—
James Bonar & Co., Pittsburg, Pa.

GEARING—
I. & E. Greenwald Co., Cincinnati, O.
The R. D. Nuttall Co., Allegheny, Pa.
The Van Dorn & Dutton Co., Cleveland, O.
F. H. Bultman & Co , Cleveland, O.
Fraser & Chalmers, Chicago, Ill.
Southwark Foundry & Machine Co., Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.
Nazel & Bassett, Philadelphia, Pa.

GEAR CUTTERS—
F. H. Bultman & Co., Cleveland, O.

GEAR CUTTING—
The R. D. Nuttall Co., Allegheny, Pa.
The Van Dorn & Dutton Co., Cleveland, O.
F. H. Bultman & Co., Cleveland, O.

GEAR LUBRICANTS—
The Ironsides Company, Columbus, O.

GIRDER WORK—
Wm. B. Scaife & Sons, Pittsburg, Pa.

GRINDSTONES—
C. H. Besly & Co., Chicago, Ill.

GRAPHITE PAINT—
Jos Dixon Crucible Co., Jersey City, N. J.

GRATE BARS—
Geo. B. Sennett Co., Youngstown, Ohio.

GRAY IRON CASTINGS—
W. A. Jones Foundry Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.

HACK SAWS—
O & C Co., Chicago, Ill.
Cleveland Punch & Shear Wks. Co., Cleveland, O

HANGERS—
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & E. Greenwald Co., Cincinnati, O.

HARNESS SNAPS—
Covert Mfg. Co., West Troy, N. Y.

HEATERS AND PURIFIERS—
Harrison Safety Boiler Works, Philadelphia.
James Bonar & Co., Pittsburg, Pa.
Wefugo Co., Cincinnati, O.
Austin Separator Co., Detroit, Mich.
The United Boiler Co., Girard, O.

HEAVY HARDWARE—
C. H. Besly & Co., Chicago, Ill.

HOISTS—
The Aultman Co., Canton, O.
Lidgerwood Mfg. Co., New York City.

HOISTING ENGINES—
The Edward P Allis Co., Milwaukee, Wis.
Lidgerwood Mfg Co. New York City.
Exeter Machine Works, Pittston, Pa.
The Aultman Co., Canton, O.
Webster, Camp & Lane Machine Co., Akron, O.
Excelsior Iron Works Co., Cleveland, O.
J. & G. Obenberger, Milwaukee, Wis.

HOISTING MACHINERY—
Exeter Machine Works, Pittston, Pa.
Link-Belt Machinery Co., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, O.
Excelsior Iron Works Co., Cleveland, O.
Lidgerwood Mfg. Co. New York City.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster, Camp & Lane Machine Co., Akron, O.
J. & G. Obenberger, Milwaukee, Wis.

HORSE SHOES—
Phoenix Horse Shoe Co., Joliet, Ill.

INDUSTRIAL CARS—
The Pressed Steel Car Co., Pittsburg, Pa.

INGOT MOLDS—
Lorain Foundry Co., Lorain, O.

INJECTORS—
C. H. Besly & Co., Chicago, Ill.
Manning, Maxwell & Moore, New York City.
James Bonar & Co., Pittsburg, Pa.

INSURANCE COMPANIES—
Hartford Steam Boiler I. & I. Co., Hartford, Ct.

IRON BUILDINGS—
Illinois Steel Co., Chicago, Ill.
Schiffler Bridge Co., Pittsburg, Pa.
Riter-Conley Co., Pittsburg, Pa.
Wm. B. Scaife & Sons, Pittsburg, Pa.

IRON, NAILS AND STEEL—
C. H. Besly & Co., Chicago, Ill.
E. H. Stroud & Co., Chicago, Ill.
L. K. Hirsch, Chicago, Ill.

IRON AND STEEL ROOFING—
Berger Mfg. Co., Canton, O.
Ætna Standard Iron & Steel Co., Bridgeport, O.
Cincinnati Corrugating Co., Piqua, O.
Wm. B. Scaife & Sons, Pittsburg, Pa.

IRON ORE—
Lake Superior Consolidated Iron Mines New York City, N. Y.
Oglebay, Norton & Co., Cleveland, O.
Pickands, Brown & Co., Chicago, Ill.
M. A. Hanna & Co., Cleveland, O.
Drake Bartow & Co., Cleveland, O.
Pickands, Mather & Co., Cleveland, O.
J. Wesley Pullman, Philadelphia, Pa.
Tod, Stambaugh & Co., Cleveland, O.

IRON WORKING TOOLS—
Avery Stamping Co., Cleveland, O.
American Tool Works Co., Cincinnati, O.
Cleveland Punch & Shear Wks. Co ,Cleveland,O.
H. Bickford, Lakeport, N. H
C. H. Besly & Co. Chicago Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Armstrong Bros. Tool Co., Chicago, Ill.
American Machinery & Trading Co., N. Y. City.
F. H. Bultman & Co., Cleveland, O.
The Armstrong Mfg. Co., Bridgeport, Conn.
Bickford Drill & Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield, Mass
W. P. Davis Machine Co., Rochester, N. Y.
Manning, Maxwell & Moore, New York City.
Bertsch & Co., Cambridge City, Ind.

LADLES—
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.
The United Boiler Co., Girard, O.
Wm. B. Pollock Co , Youngstown, O.

LATHES—
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O.
Manning Maxwell & Moore, New York City.
American Tool Works Co., Cincinnati, O.

LINK BELTING—
The Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.

LOCOMOTIVES—
Hyde Bros. & Co., Pittsburg, Pa.

LUBRICANTS—
The Ironsides Co., Columbus, O.

MACHINISTS' TOOLS AND SUPPLIES—
American Tool Works Co., Cincinnati, O.
W. P. Davis Machine Co., Rochester, N. Y.
American Machinery & Trading Co., N. Y. City.
H. Bickford, Lakeport, N. H.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Bertsch & Co., Cambridge City, Ind.
Armstrong Bros. Tool Co., Chicago, Ill.
Bickford Drill & Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield Mass.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.
F. H. Bultman & Co., Cleveland, O.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Nazel & Bassett, Philadelphia, Pa.

MACHINE SCREWS—
C. H. Besly & Co., Chicago, Ill.

MACHINE SHOPS—
The R. D. Nuttall Co., Allegheny, Pa.
Danielson Machine & Tool Co., Cleveland, O.

MACHINERY AND TOOL STEEL—
C. H. Besley & Co., Chicago, Ill.
Bræburn Steel Co., Bræburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa
Byron H. White, Chicago, Ill.
Morris & Bailey Steel Co., Pittsburg, Pa.
Monongahela Iron & Steel Co., Pittsburg, Pa.

MAGNESIA COVERING—
C. H. Besly & Co., Chicago, Ill.
James B. Clow & Sons, Chicago, Ill.

MALLEABLE FOUNDRY PLANTS—
Whiting Foundry Equipment Co., Harvey, Ill.

MALLEABLE CASTINGS—
Acme Malleable Iron Works, Buffalo, N. Y.
Buhl Malleable Co., Detroit, Mich.

MANILLA ROPE COATING—
The Ironsides Co., Columbus, O.

MANUFACTURING CHEMISTS—
Wefugo Co., Cincinnati, O.
Grasselli Chemical Co., Cleveland, O.

MANUFACTURED IRON AND STEEL—
Bourne-Fuller & Co., Cleveland, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
Champion Iron & Steel Co., Muskegon, Mich.
The Morris & Bailey Steel Co., Pittsburg, Pa.
Cabeen Co., Philadelphia, P
Parkhurst & Wilkinson Co., Chicago, Ill.
Ohio Steel Co., Youngstown, O.
Republic Iron & Steel Co., Chicago, Ill.
Monongahela Iron & Steel Co., Pittsburg, Pa.

METAL BEARINGS—
Theo. Hiertz & Son, St. Louis, Mo.
C. H. Besly & Co., Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
Magnolia Metal Co., New York City.
Swarts Metal Refining Co., Chicago, Ills.
J. J. Ryan & Co., Chicago, Ill.

METAL CEILINGS—
Berger Manufacturing Co., Canton, O.

METAL WORK—
Avery Stamping Co., Cleveland, O.

MILL CASTINGS—
Vulcan Foundry & Machine Co., New Castle, Pa.
Schuykill Iron & Steel Co., Philadelphia, Pa.

MILLING MACHINES—
American Tool Works Co., Cincinnati, O.
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.

MINING MACHINERY—
C. H. Besly & Co., Chicago, Ill.
The Edward P. Allis Co., Milwaukee, Wis,
Jeffrey Mfg. Co., Columbus, O.
Lidgerwood Mfg. Co , New Yotk City.
Exeter Machine Works, Pittson, Pa.
Wm. Cramp & Sons, Philadelphia, Pa
The Bucyrus Co., South Milwaukee, Wis.
Marion Steam Shovel Co., Marion, O.
Webster, Camp & Lane Machine Co., Akron, O.
Fraser & Chalmers, Chicago, Ill.
Excelsior Iron Works Co , Cleveland, O.
Wm. B. Pollock Co., Youngstown, O.
J. & G. Obenberger, Milwaukee, Wis.

MINE PUMPS—
F. M. Prescott Steam Pump Co., Milwaukee, Wis,

MOLDING MACHINES—
Tabor Mfg. Co., Elizabeth, N. J.
Whiting Foundry Equipment Co., Harvey, Ill.
Thos. Furlow & Son, Philadelphia, Pa.
Maywood Foundry & Machine Co., Chicago, Ill.

MOLDING SAND—
Ohio Sand Co., Conneaut, O.
F. B. Stevens, Detroit, Mich.
Garden City Sand Co., Chicago, Ill.
Newport Sand Bank Co., Newport, Ky.

MULTIPLE DRILLS—
Bickford Drill and Tool Co., Cincinnati, O.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Baush & Harris Machine Tool Co., Springfield, Mass.

NICKEL PLATING OUTFITS—
Northampton Emery Wheel Co., Chicago, Ill.

NUTS (Self Locking)—
National Elastic Nut Co., Milwaukee, Wis.

NUTS AND BOLTS—
Upson Nut Co., Cleveland, O
National Elastic Nut Co., Milwaukee, Wis.

OILLESS BEARINGS—
C. H. Besly & Co., Chicago, Ill.

OIL BURNERS—
Rockwell Engineering Co., New York City.

OIL CUPS—
C. H. Besly & Co., Chicago, Ill.
James Bonar & Co., Pittsburg, Pa

OIL FILTERS—
James Bonar & Co., Pittsburg, Pa.

OIL PUMPS—
C. H. Besly & Co., Chicago, Ill.

OIL STORAGE TANKS—
Wm. B. Pollock Co., Youngstown, O.

OIL SEPARATORS—
Harrison Safety Boiler Works, Philadelphia, Pa.
Austin Separator Co., Detroit, Mich.
American Tool Works Co., Cincinnati, O.

OIL TANKS AND CARS—
Wm. B. Pollock Co., Youngstown, O.

ORE CARS—
The Pressed Steel Co. Pittsburg, Pa.

ORE CRUSHERS—
The Edward P. Allis Co., Milwaukee, Wis.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Fraser & Chalmers Chicago, Ill.

ORE SCREENS—
Rob't Aitchison Per. Metal Co., Chicago, Ill.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.
Hendrick Mfg. Co., Carbondale, Pa.

ORE TESTING MACHINERY—
Keystone Driller Co., Beaver Falls, Pa

PACKING—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
James B. Clow & Sons, Chicago, Ill.

PAINT—
Iron Clad Paint Co., Cleveland, O.
Jos. Dixon Crucible Co., Jersey City, N. J.
The Ironsides Co., Columbus, O.

PATTERN WORKS—
Gobeille Pattern Co., Cleveland. O.
Forsythe Pattern Works, Youngstown, O.

PERFORATED METALS—
Aitchison Perforated Metal Co., Chicago, Ill.
Fraser & Chalmers, Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.

PIG IRON—
Cabeen Co., Philadelphia, Pa.
Rogers, Brown & Co., Cincinnati, O.
Reed F. Blair & Co., Pittsburg, Pa.
Clinton Iron & Steel Co., Pittsburg.
Bourne-Fuller Co. Cleveland, O.
M. A. Hanna & Co., Cleveland, O.
E. H. Stroud & Co., Chicago, Ill.
Pickands, Brown & Co., Chicago, Ill.
F. B. Stevens, Detroit, Mich.
McKeefrey & Co., Leetonia, O.
Superior Charcoal Iron Co., Grand Rapids, Mich
Spearman Iron Co., Sharpsville, Pa.
Hickman, Williams & Co., Chicago, Ill,
Pickands, Mather & Co., Cleveland, O.
Republic Iron & Steel Co., Chicago, Ill.
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill,
J. H. Hillman & Son, Pittsburg, Pa.

PIG IRON CASTING APPARATUS—
Heyl & Patterson, Pittsburg, Pa.
G. H. Ginther, Special Agent, Pittsburg, Pa.

PIPE (CAST IRON)—
James B. Clow & Sons, Chicago, Ill.

PIPE (RIVETED STEEL)—
Wm. B. Scaife & Sons, Pittsburg, Pa.
Wm. B. Pollock Co., Youngstown, O.

PIPE COVERING—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.

PIPE CUTTING AND THREADING MACHINES—
The Armstrong Mfg. Co., Bridgeport, Conn

PIPE FOUNDRY PLANTS—
Whiting Foundry Equipment Co., Harvey, Ill.

PISTON RODS—
Bethlehem Steel Co., So. Bethlehem, Pa.

PLANERS—
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O
Manning, Maxwell & Moore, New York City.
American Tool Works Co., Cincinnati, O.

PLATES—
Enterprise Boiler Co., Youngstown, O.
Republic Iron & Steel Co., Chcago, Ill.
Illinois Steel Co., Chicago, Ill.

PLUMBERS' AND GAS FITTERS' SUPPLIES—
C. H. Besly & Co., Chicago, Ill.
James B. Clow & Sons, Chicago, Ill.

PNEUMATIC APPLIANCES—
Clayton Air Compressor Works, New York.
Q & C Co., Chicago. Ill.
W. J. Schaefer & Co., New York City.

PORTABLE FORGE—
C. H. Besly & Co., Chicago, Ill.
Vulcan Mfg. Co., Pittsburg, Pa.

POWER DROP HAMMERS—
Baush & Harris Machine Tool Co., Springfield Mass.
Mossberg & Granville Mfg. Co., Providence, R.I.
American Machinery & Trading Co., N. Y. City.

POWER PRESSES—
Avery Stamping Co., Cleveland, O.
Bertsch & Co., Cambridge City, Ind.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
E. Konigslow & Bro. Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.
Mossberg & Granville Mfg. Co., Providence, R.I.

POWER TRANSMISSON MACHINERY—
Jeffrey Mfg. Co., Columbus, O.
E. A. Delano, Chicago. Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & E. Greenwald Co., Cincinnati, O.

PRESSES—
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.
E. Konigslow & Bro. Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.
Avery Stamping Co., Cleveland, O.
Mossberg & Granville Mfg. Co., Providence, R.I.
Cleveland Punch & Shear Wks. Co., Cleveland, O.

PRESSURE GAUGES—
The Bristol Co., Waterbury, Conn.
James Bonar & Co., Pittsburg, Pa.

PULLEYS—
W. A. Jones Foundry Co., Chicago, Ill
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
Jones & Laughlins, Ltd., Pittsburg, Pa
I. & E. Greenwald Co., Cincinnati, O.

PUMPS (STEAM)—
The Edward P. Allis Co., Milwaukee, Wis
Blakeslee Mfg. Co., Du Quoin, Ill,
Fred M. Prescott Steam Pump Co., Milwaukee Wis.
Hall Steam Pump Co., Pittsburg, Pa.
Southwark Foundry & Machine Co., Philadelphia, Pa.

PUNCHES—
E. Konigslow & Bro. Cleveland, O.

PYROMETERS—
Edward Brown, Philadelphia. Pa.
Vulcan Mfg. Co., Pittsburg, Pa.

RADIAL DRILLS—
Bickford Drill and Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield, Mass.
American Tool Works Co., Cincinnati, O.

RAILS—
Hyde Bros. & Co., Pittsburg, Pa.

RAILWAY SUPPLIES—
Cleveland City Forge & Iron Co., Cleveland, O.
Garden City Sand Co., Chicago, Ill.
Hyde Bros & Co., Pittsburg, Pa.

RAW HIDE GEARS—
Nasel & Bassett, Philadelphia, Pa.

RELAYING RAILS—
L. K. Hirsch, Chicago, Ill.
Hyde Bros. & Co., Pittsburg, Pa.

RIVETS—
Champion Rivet Co., Cleveland, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
Youngstown Rivet Co., Youngstown, O.

RIVETED STEEL PIPE—
The Wm. B. Pollock Co. Youngstown, O.

ROCK DRILLS—
Rand Drill Co., Chicago, Ill.
The Ingersoll-Sergeant Drill Co., New York.

ROLL FORGINGS—
Samuel Trethewey & Co., Pittsburg, Pa.
Frankford Steel & Forging Co., Philadelphia, Pa.

ROLLER BEARINGS—
Mossberg & Granville Mfg. Co., Providence, R.I.

ROLLING MILLS—
Mossberg & Granville Mfg. Co., Providence, R.I.

ROLLING MILL MACHINERY—
The United Boiler Co., Girard, O.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.
The Lloyd Booth Co., Youngstown, O.
Vulcan Foundry & Machine Co., New Castle, Pa.
Mossberg & Granville Mfg Co., Providence, R.I.
West Penn Foundry & Machine Co., Avonmore, Pa.

ROOFS—
Shiffler Bridge Co., Pittsburg.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Wm. B. Scaife & Sons, Pittsburg, Pa.

ROPE AND CORDAGE—
Waterbury Rope Co., New York City.

SAWS—
Peter Gerlach & Co., Cleveland, O.

SCRAP IRON—
L. K. Hirsch, Chicago, Ill.
Hyde Bros. & Co., Pittsburg, Pa.
Illinois Steel Co., Chicago, Ill.

SCREENS FOR COAL, ORE, ETC.—
Robt. Aitchison Perforated Metal Co., Chicago.
Hendrick Mfg. Co., Carbondale, Pa.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.

SCREWS—
C. H. Besly & Co., Chicago, Ill.
Upson Nut Co., Cleveland, O.
Chicago Screw Co., Chicago, Ill

SCREW MACHINES—
Cleveland Ball & Screw Co., Cleveland, O.
American Tool Works Co., Cincinnati, O.

SECOND-HAND MACHINERY—
Hyde Bros & Co., Pittsburg, Pa.
Torbert & Peckham, Chicago, Ill.
American Machinery & Trading Co., N. Y. City.

SENSITIVE DRILLS—
American Tool Works Co., Cincinnati, O.

SEPARATORS—
Harrison Safety Boiler Works, Philadelphia, Pa.
Austin Separator Co., Detroit, Mich.
James Bonar & Co., Pittsburg, Pa.

SHAFTING—
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
Fitzsimmons & Co., Cleveland, O.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
Jones & Laughlins, Ltd., Pittsburg, Pa
I. & E. Greenwald Co., Cincinnati, O.
Bethlehem Steel Co., South Bethlehem, Pa.
American Steel & Wire Co., Chicago, Ill.

SHAPERS—
W. P. Davis Machine Co., Rochester, N. Y.
Baush & Harris Machine Tool Co., Springfield, Mass.
American Tool Works Co., Cincinnati, O.

SHEARING AND PUNCHING MACHINERY—
Bertsch & Co., Cambridge City, Ind.
Danielson Machine & Tool Co., Cleveland, O.
American Tool Works Co., Cincinnati, O.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Mossberg & Granville Mfg. Co., Providence, R.I.

SHEAR KNIVES—
Samuel Trethewey & Co., Pittsburg, Pa.

SHEET IRON—
Ætna-Standard Iron & Steel Co., Bridgeport, O.
E. H. Stroud & Co., Chicago. Ill.
Republic Iron & Steel Co., Chicago, Ill.
Struthers Iron & Steel Co., Struthers, O.

SHIP YARDS—
Wm. Cramp & Sons, Philadelphia, Pa.

SOLID STEEL SHEAR KNIVES—
Samuel Trethewey & Co., Pittsburg, Pa.

SPECIAL MACHINERY—
Cleveland Punch & Shear Wks. Co., Cleveland, O.
American Tool Works Co., Cincinnati, O.
James Bonar & Co., Pittsburg, Pa.
Avery Stamping Co., Cleveland, O.
Mossberg & Granville Mfg. Co., Providence, R.I.
Q & C Co., Chicago, Ill.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
E. Konigslow & Bro. Cleveland, O.
Wheeling Mold & Foundry Co., Wheeling, W. Va.
Danielson Machine & Tool Co., Cleveland, O.
Nasel & Bassett, Philadelphia, Pa.

STACKS—
Wm. B. Scaife & Sons, Pittsburg, Pa.

STAND PIPES—
The Wm. B. Pollock Co., Youngstown, O.
The United Boiler Co., Girard, O.

STEAM BOILER INSPECTORS—
Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn.

STEAM PIPE AND BOILER COVERING—
C. H. Besly & Co., Chicago Ill

STEAM PACKING—
James B. Clow & Sons, Chicago, Ill.
C. H. Besly & Co., Chicago, Ill.

STEAM PUMPS—
Hall Steam Pump Co., Pittsburg, Pa.
Blakeslee Mfg. Co., Du Quoin, Ill.
Fred. M. Prescott Steam Pump Co., Milwaukee, Wis.
Edw. P. Allis Co., Milwaukee, Wis.
Southwark Foundry and Machine Co., Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.

STEAM SEPARATORS—
James Bonar & Co., Pittsburg, Pa.
Austin Separator Co., Detroit, Mich.
Harrison Safety Boiler Works, Philadelphia, Pa,

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E. H. Stroud & Co., Chicago, Ill.
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Cabeen Co., Philadelphia, Pa.
Champion Iron & Steel Co., Muskegon, Mich.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa.
The Morris & Bailey Steel Co., Pittsburg, Pa.
Byron H. White, Chicago, Ill.
Monongahela Iron & Steel Co., Pittsburg, Pa.
American Steel Hoop Co, Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill.
Struthers Iron & Steel Co., Struthers, O.

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Cleveland Ball & Screw Co., Cleveland, O.

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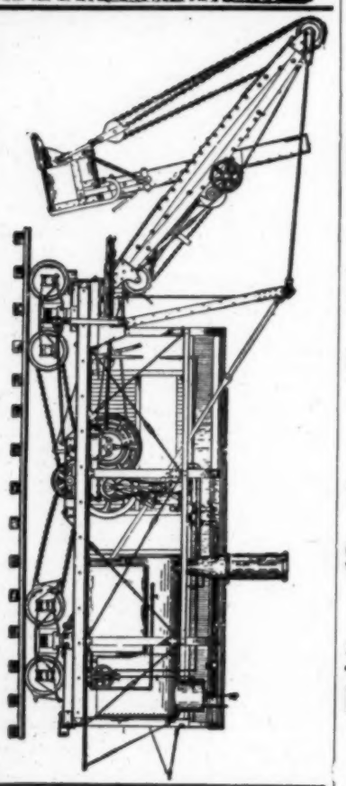

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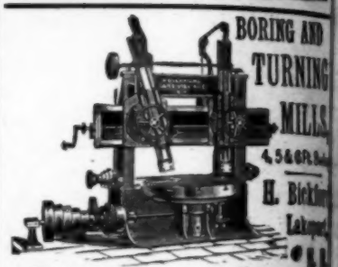

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